Vol. XXVI.]
No. 633.]

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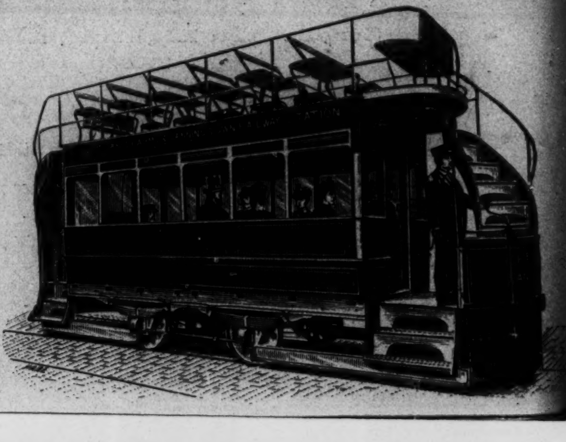

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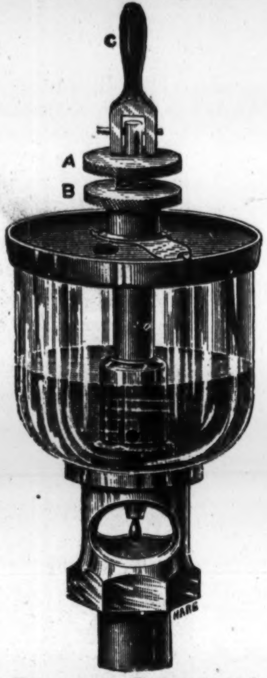

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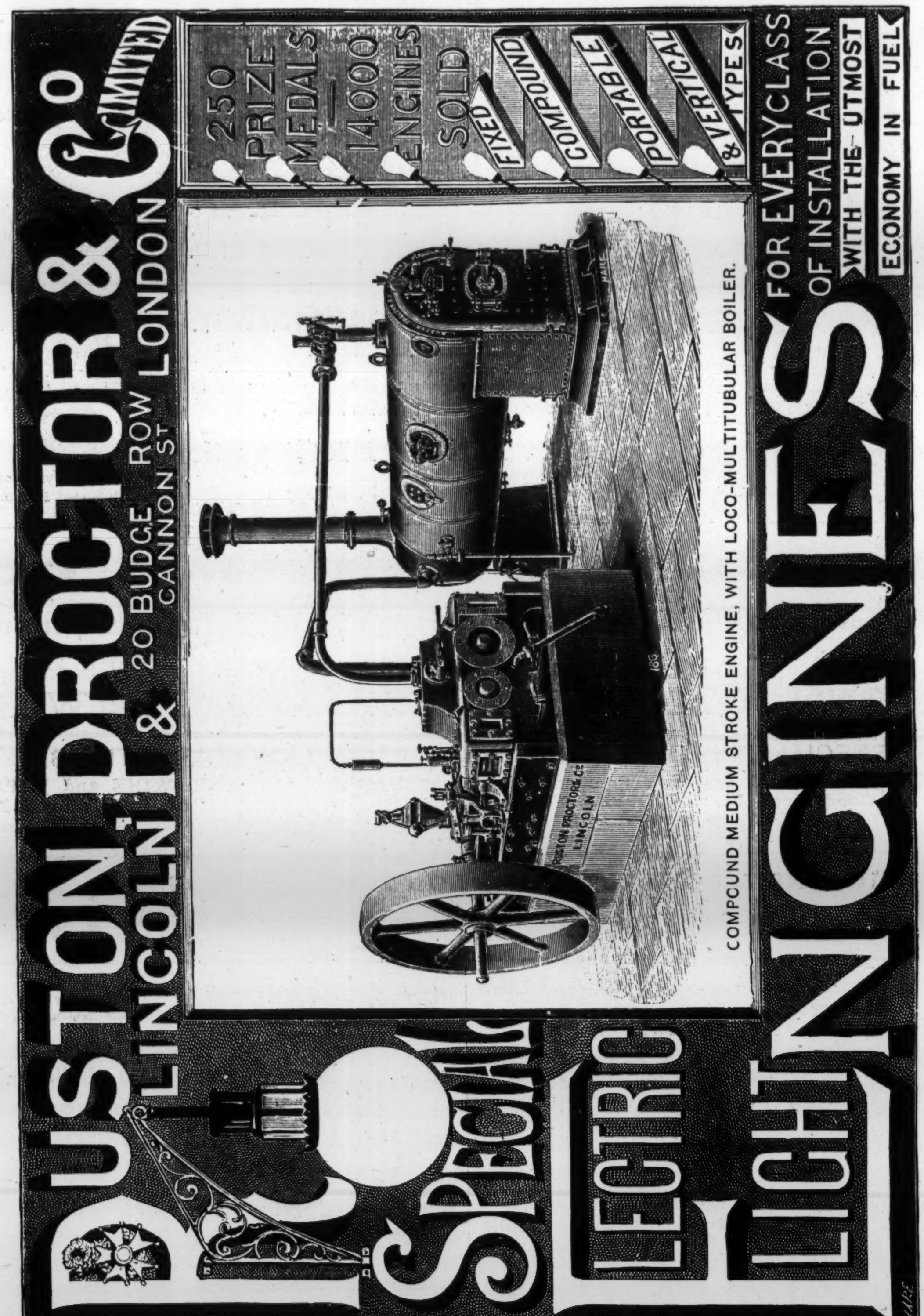

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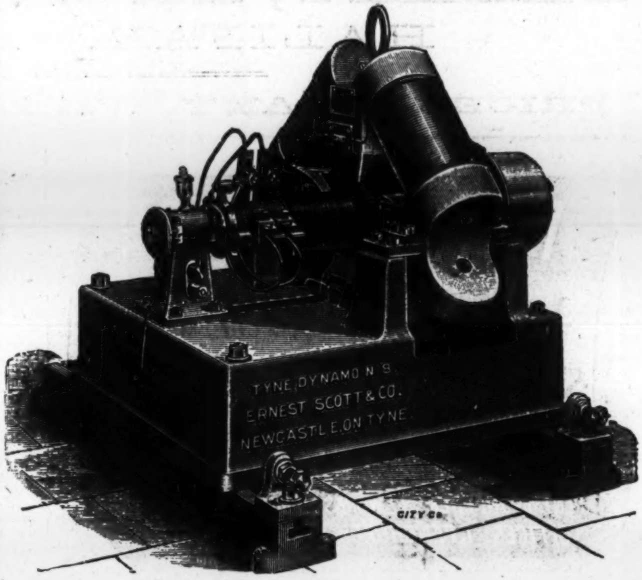
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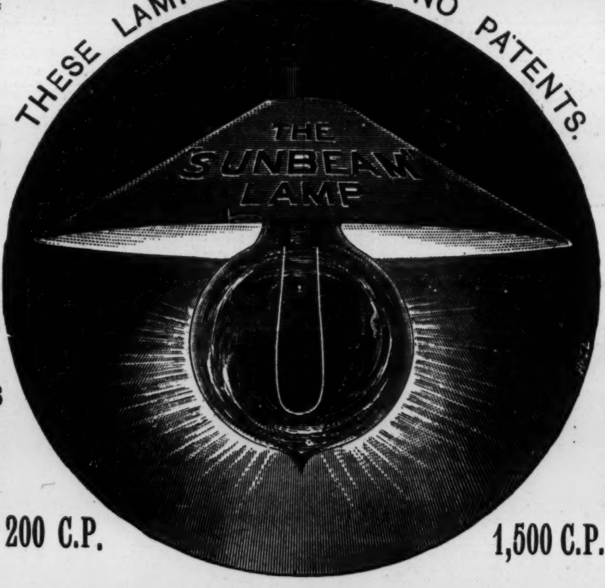

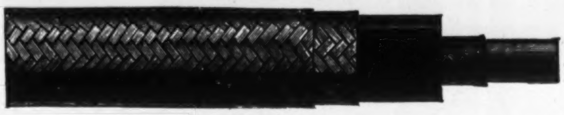

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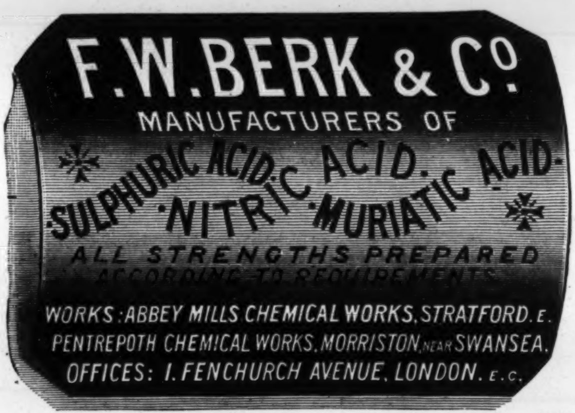

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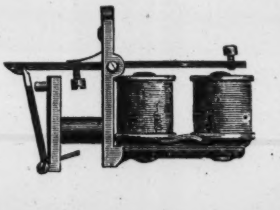

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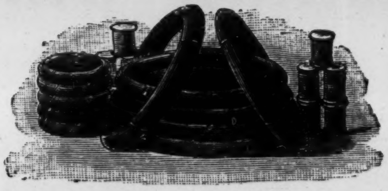

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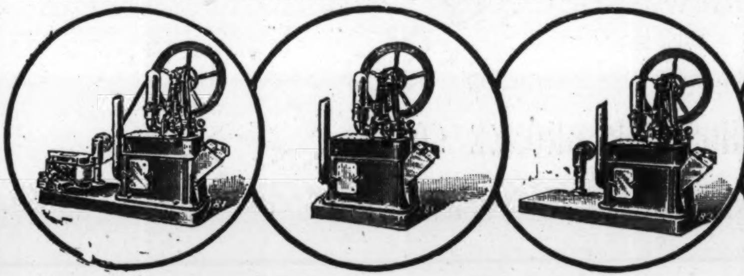

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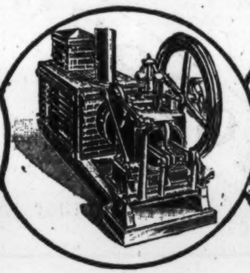

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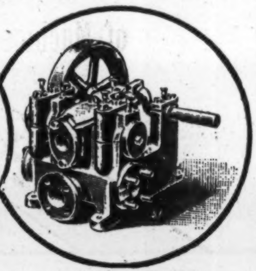

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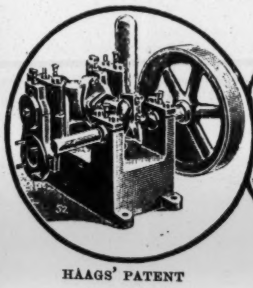

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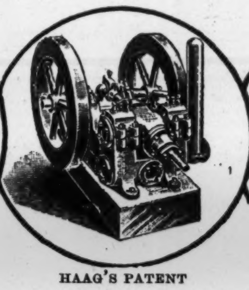

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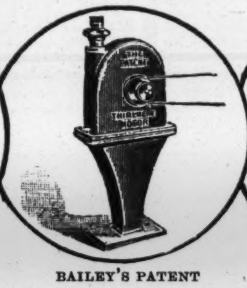

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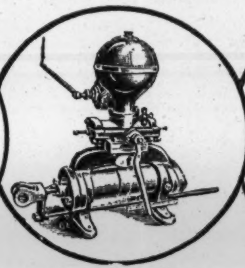

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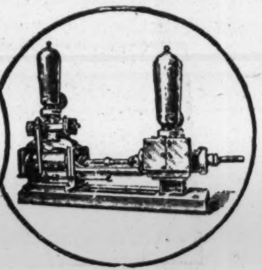

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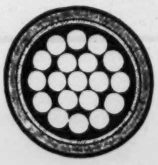

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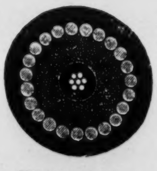

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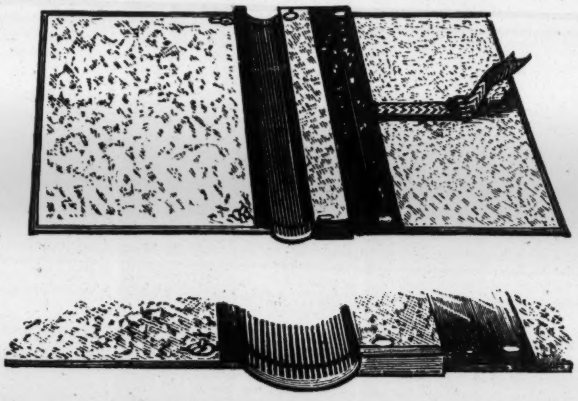

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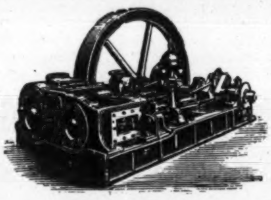

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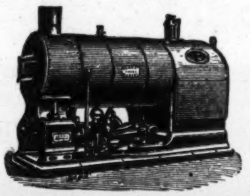

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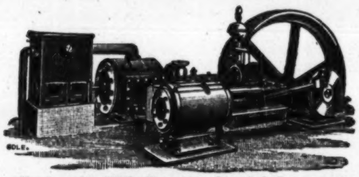

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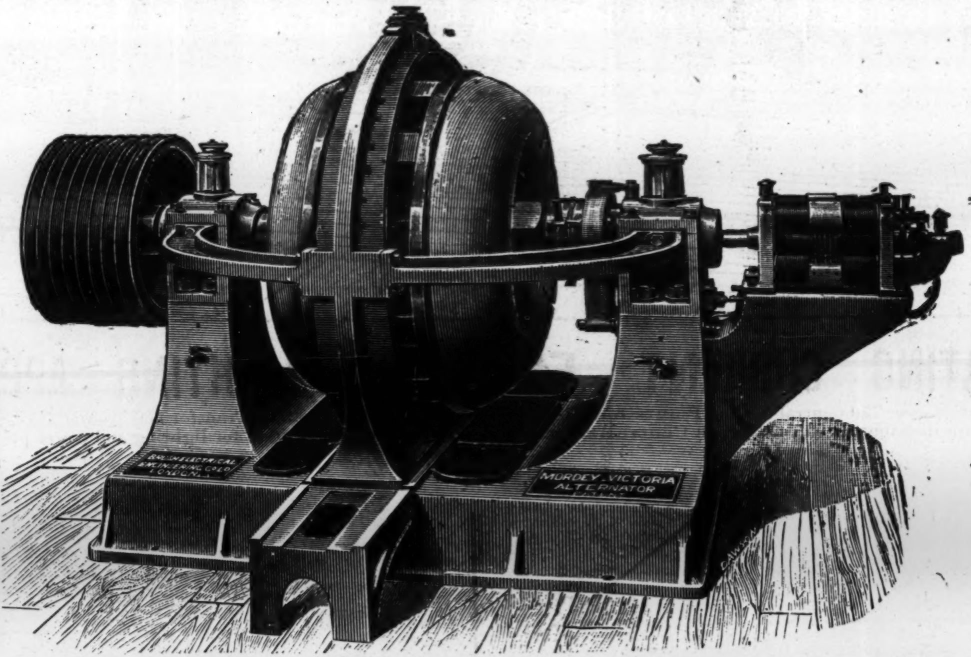
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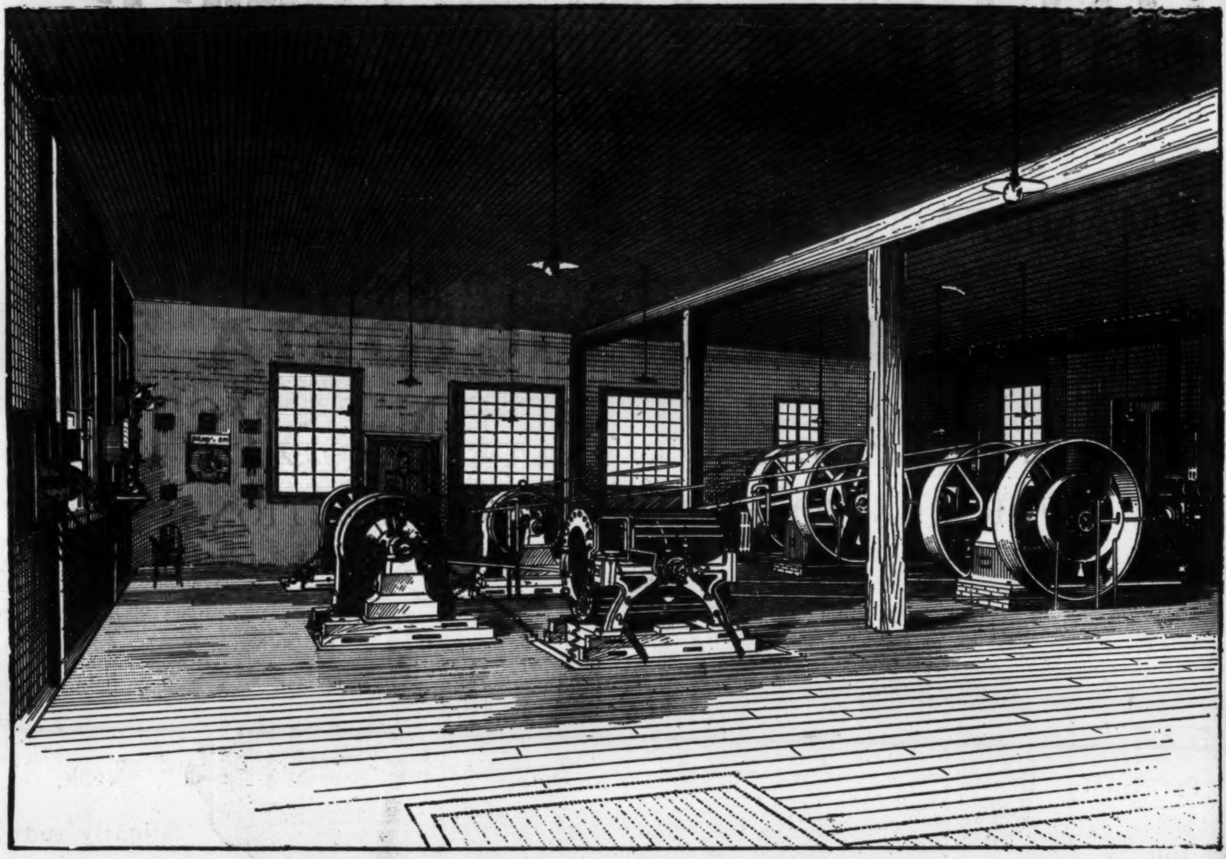

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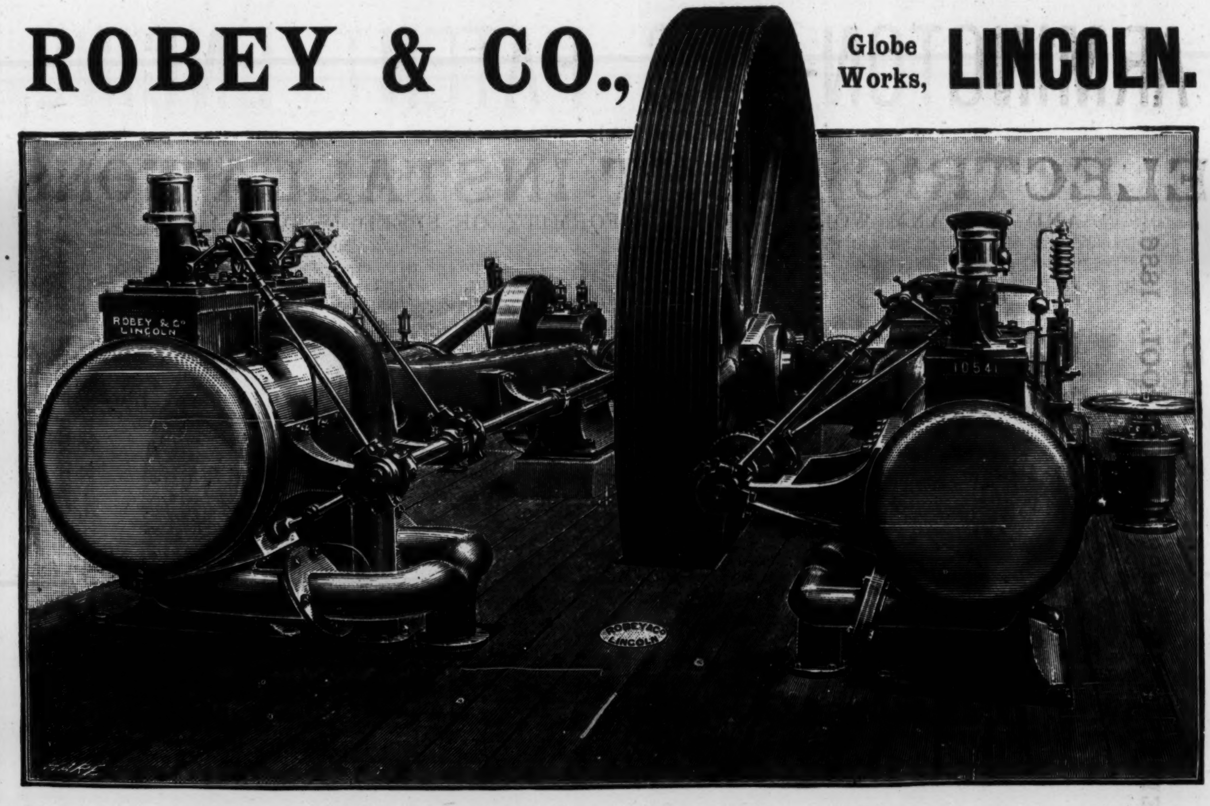

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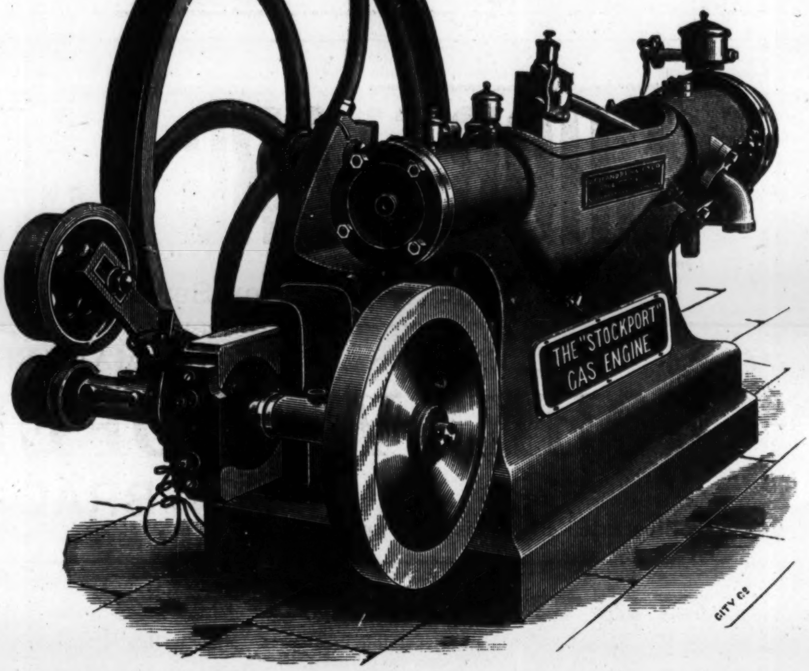

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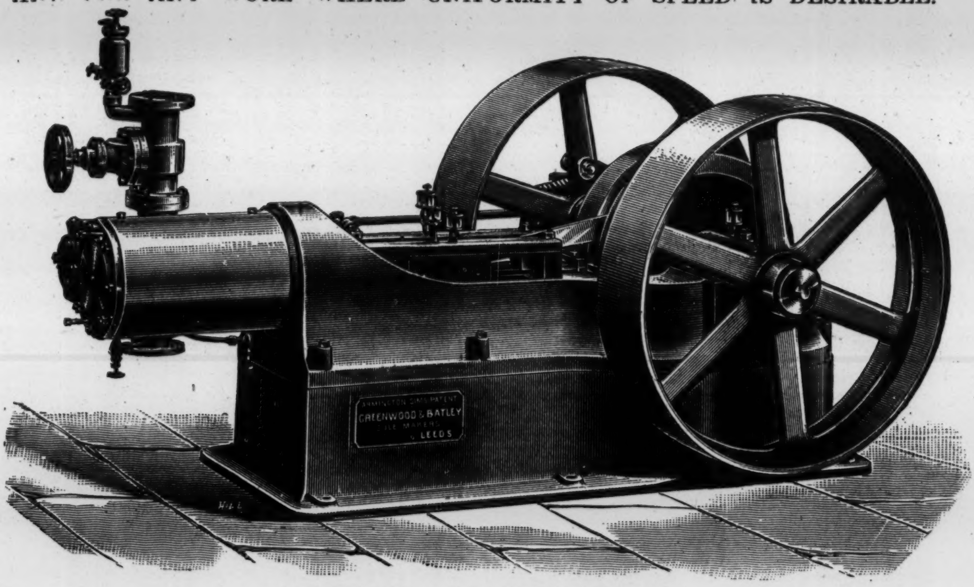

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SECRETARY AND REGISTERED OFFICES.—W. H. FOX, F.C.A., 9, Austin Friars, London, E.C.

PROSPECTUS.

1. This company was formed in February, 1888, for the purpose of generating, storing, and supplying Electricity for Lighting and motive purposes, and has recently obtained a Board of Trade Order and Special Act of Parliament authorising it to supply electricity for all public and private purposes over about a square mile in the central portion of the parish of St. Mary Abbotts, Kensington, the exact area of which is shown on the plan accompanying this Prospectus, and includes Kensington Park, Holland Park, Campden Hill, Melbury Road, Addison Road, Phillimore Gardens, Argyll Road, Pembridge Square, Ladbroke Square, Linden Gardens, Clanricarde Gardens, &c., &c.

2. The powers obtained by this Company, which are the only powers granted within the limits shown on the Map, are granted for a duration of forty-two years (at the expiration of which period the local authority may acquire by purchase the undertaking of the Company), with power to the Company to retire from the undertaking under certain conditions. Copies of the Act and Provisional Order can be inspected at the Offices of the Company and at the Solicitors' Offices, or can be obtained from the Government Printers (Messrs. Eyre and Spottiswoode) at a cost of 9s.

3. The spread of Electric Lighting in the United Kingdom, which has been hitherto retarded owing to the restrictions in the Electric Lighting Act of 1882, is now likely to proceed with considerable vigour, owing to these restrictions having been removed by Lord Thurlow's Act of 1888. The installations of systems of Electric Lighting from Central Stations, which have been carried out under the Act of 1882, have proved that the machinery now in use is capable of converting over 92 per cent. of mechanical energy into electricity. Every element of doubt or danger has been practically removed, and Electric Light Installations can now be carried out with the same certainty as similar installations of water or gas. Simultaneously with the increase of efficiency the expense of production has been diminished, until at the present time Lighting by Electricity in dwelling-houses may be actually regarded as cheaper than lighting by Gas, provided expenses caused by deterioration of interior decorations, &c., are taken into consideration. The following is an extract from the Report of Major Marindin, which was specially prepared at the request of the Board of Trade:—"It must be admitted that the science of Electric Lighting has now reached the point at which a supply can be made which will be of very great benefit to the public, and that the power of obtaining this supply should be within the reach of all persons who may require it."

4. It will be observed that the company has secured one of the best districts in the Metropolis, comprising as it does a compact group of highly rented houses inhabited by a wealthy population, and in which there is every reason for supposing that the Electric Light will be in great demand. The rateable value within the Company's area of supply is £372,326 per annum.

5. A convenient site for a Central Station has been provisionally secured at Victoria Gardens, Notting Hill, which is within the area of supply; and, consequently, a great saving of expense will be effected in the laying of mains, &c. It is intended, in accordance with the powers granted to the Company by the Act, to supply the light entirely by underground mains and thus avoid the many dangers, and consequent expense, incident to overhead wires. It is also intended to have the electric current supplied at one constant pressure, night and day, and the tension will be so low that no danger will be experienced if by carelessness the wires are touched. By the system to be adopted lamps of any desired power can be used at the same time in the house, and any number of these lamps may be lighted and extinguished at the will of the consumer, who will only have to pay for the actual energy (as measured by meter) consumed in the lamps he may have in use. The lighting in each house will be entirely distinct from, and unaffected by, that of the neighbouring houses. Any failure of the light, owing to any accident to the machinery, will be provided against by the use of storage batteries, as an essential part of the system of supply.

6. The Directors, who are inhabitants of the district with local experience and influence, have, with the aid of their friends, at considerable trouble and personal expense, obtained the necessary powers from the Parish, the Board of Trade, and Parliament. In consideration of their services, they have had reserved to them or their nominees the right to subscribe for, and to have allotted to them at par the 550 Founders' Shares, which entitle them only to a deferred interest in the concern. In accordance with the provisions of the Articles of Association, no Dividend will be paid on the Founders' Shares until after six per cent. has been distributed in any one year to the Ordinary Shareholders. All surplus profits will then be divided into two moieties, one of which will be distributed as a surplus Dividend to the Ordinary Shareholders, and the other will be divided among the holders of the Founders' Shares.

7. The following estimate of the probable profits of the Company has been prepared by the Company's Engineers:—

"THE DIRECTORS, *21st October*, 1889.
"Notting Hill Electric Lighting Co., Ltd., 9, Austin Friars.

"Gentlemen,—We beg to report as follows as to the cost of erecting the necessary plant for supplying sufficient current over an area in which 50,000 lights have been fixed, and the revenue arising from same:—The plant could be erected for a sum of £67,000, and assuming the revenue per lamp to be the same as that actually paid in a neighbouring district, the profit would be about £13,000 per annum after paying all expenses of management.

"We are, Gentlemen, your obedient Servants,

"J. E. SPAGNOLETTI & CROOKES.
"R. E. CROMPTON."

8. No patents have been bought, no promotion money has been paid, and the whole of the capital to be subscribed will (except about £4,000, the estimated cost of law and other charges in obtaining the Provisional Order and Special Act, &c., advertising, brokerages, and preliminary expenses, and on account of which £1,200 have already been paid) be used in the business of the company.

9. It is proposed to enter into two contracts, in relation to the acquisition of a lease (having 60 years unexpired) of certain property in Victoria Gardens, Notting Hill, where the central station will be erected. Certain underwriting contracts, too numerous to be set out, have been entered into with holders of some of the Founders' Shares, under which such holders will subscribe for Ordinary Shares. A list thereof, giving the dates and names of parties thereto, can be inspected at the office of the Solicitor of the Company. Applicants for Shares shall be deemed to have full notice thereof within the meaning of the Companies' Act, 1867, and to have waived any fuller compliance with such Act in reference thereto.

10. It is intended to apply to the Stock Exchange for a quotation of the Company's Shares.

11. Prospectuses can be obtained from the Bankers, Brokers, and Solicitors, and at the Company's Offices. Application for Shares should be made on the accompanying form, and sent, with the amount of deposit, to either of the Company's Bankers. If no allotment is made, the amount paid with the application will be returned in full. If a part only of the Shares applied for is allotted, the surplus of the amount paid with the application as deposit will be applied in part payment of the allotment money. Applicants for Shares residing within the Area of Supply who intend to be supplied by the Company with current for lighting purposes will receive favourable consideration in order as much as possible to make the Company a co-operative concern.

LONDON, *9th January*, 1890.

3531

Telegrams: "ELECTRICITY."] [Telephone No. 1887.

THE GENERAL ELECTRIC Co. Ltd.

[G. BINSWANGER, MANAGING DIRECTOR.] (OF LONDON AND MANCHESTER).

TRADE MARK

Works:—45, CHAPEL STREET, SALFORD, MANCHESTER, and BENTHAM ROAD, HOMERTON, LONDON.

Head Office and Warehouses:—
71, QUEEN VICTORIA ST.,
LONDON, E.C.

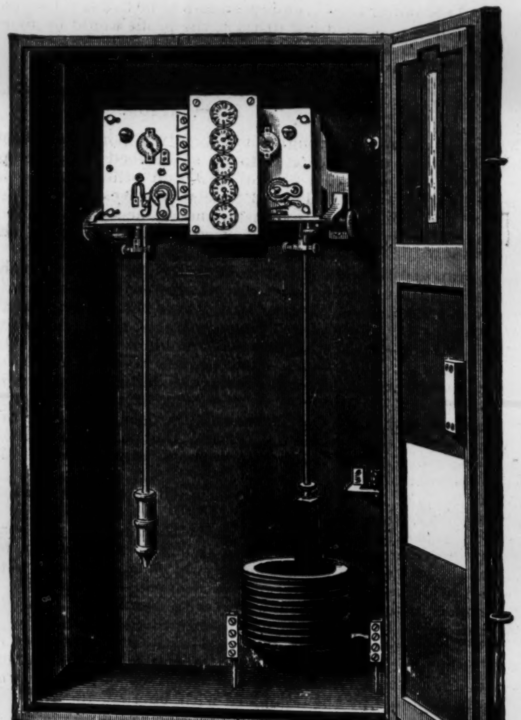
"DOVILO" VOLT and AMMETERS

PERFECT CALIBRATION GUARANTEED—THE LONGEST RANGE SCALE ON THE MARKET.

Voltmeters reading to—	£	s.	d.
20 Volts	3	10	0
120 "	4	0	0
150 "	4	10	0
250 "	5	10	0
500 "	7	10	0
1,000 "	8	0	0

Ammeters reading to—	£	s.	d.
20 Ampères	3	3	0
60 "	3	10	0
160 "	4	15	0
300 "	5	0	0
600 "	5	10	0
1,000 "	7	0	0

THESE INSTRUMENTS MAY BE LEFT CONTINUALLY IN CIRCUIT.



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FOR DIRECT OR ALTERNATING CURRENTS.

Meter complete for Continuous or Alternating Currents to carry:—	£	s.	d.
12 Amperes	11	10	0
25 "	12	10	0
50 "	14	0	0
100 "	16	0	0
150 "	18	0	0
200 "	20	0	0
300 "	25	0	0
400 "	30	0	0
500 "	35	0	0

Large Discounts to Central Stations.

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JAN 23 1890

THE TELEGRAPHIC JOURNAL AND
ELECTRICAL REVIEW.

VOL. XXVI. JANUARY 10, 1890. No. 633

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COMPANIES DIRECTORS.

AMONG the companies registered at Somerset House last year, were over fifty undertakings connected with electricity. At present many of these are little more than names; the returns of some, after their statutory meetings, showing them to be composed each of seven holders of one share apiece, on which nothing has been paid. They exist by virtue of the signatures of the sevens to the memoranda, with or without articles of association and of a fee paid to the Joint Stock Registrar. Their objects were mostly to obtain provisional orders if possible, and to carry them out, presumably, how they could. Not but that we should doubtless find, if we had time to read their memoranda through, they have taken powers to act as promoters, money-lenders, guarantee societies, railway and canal contractors, tramway proprietors, miners, builders, &c., &c.; and, taking a still wider breadth of view, "to carry on any other trade or business."

It is not to be supposed that the initial expenses of all or any of these companies have been incurred for the fun of the thing; and we look to next year's returns showing *large* bodies of shareholders, and much paid-up and "considered as paid-up" capital. In the spring the early varieties will throw out their prospectuses. We may expect a show of blossom in July; and by November some will have brought in their sheaves with gladness and others be frozen out.

Before they can bear fruit upward, however, they must take root downward, and assimilate that on which they are to thrive. They must obtain the needful, and have boards to spend it. Directors are supposed to represent the shareholders, but they rarely do. Who will have the directing of the affairs of all these companies, for much will depend upon that? If a clique, their hands will be pretty full. If not, who are they to be? Of established electrical companies, so far as we can gather from printed records, the boards contain some 20 per cent. of engineers (may their proportion never grow less) and 17½ per cent. with titles. The law furnishes 9½ and the military 8 per cent.; business men and gentlemen comprising the balance. Will the new companies go into the open market, so to speak, for their directorates, and encounter its competition?

Considering the enormous number coming out —the average in 1889 was eight a day—it is no wonder that we see occasionally advertisements running somewhat thus: "Wanted, two or three gentlemen of business aptitude to act as directors of a company in course of formation." Where do all the directors of all the new companies come from? One would think the stock must be almost used up, or else that the qualifications for a seat on a board cannot be very great. One meets every variety of the upper and upper middle classes of society. Some work, some only potter. Some would willingly buckle to if they only knew how; and some do not get a chance, and don't want it. They rush in with the apology that they have been at another meeting, and were unable to get away, or leave early to go elsewhere, taking care to first sign the attendance book, whereon depends their fees.

Travelled men from many lands are much to the fore: the old Indian, the old Colonial, the South American Consul, the barrister, the retired tradesman and hotel-keeper, as likewise the younger son and the man of no occupation. One would think that the men from abroad had the advice given them which, according to Marryat, used to be accorded to fresh middies searching in vain for hammock-room, to choose a soft board. They have been used to doing something, and have their savings, and gravitate towards companies. It is not always that they are a success. The titled director is often so. Liking work, or he would not do it, conciliatory in manner, and bred to speak, he is useful, and liked by his colleagues and the shareholders. Tom Moore was not the only one who dearly loved a lord.

We have known several cases of clerical directors; but the lady director has not yet appeared We should not forget the vendor, who, as a rule, is the worst man you can have on a board. His interests can hardly be identical with those of the majority of the shareholders; and yet how often is it announced that he "has consented to take a seat on the board." Of course he has. He wants to see how things are going, and to sell his shares. The admission of vendors is usually a mistake. Where old and respectable businesses are formed into companies, they are the natural directors, and in place; but otherwise they are generally better kept out.

The best directors are those who have been at the duties for years on various concerns. There is as much difference between such and the raw ones, as between the skilled mechanic and the jobbing hand who never served an apprenticeship. *Nascitur non fit* cannot be said of Directors. We have heard of born poets, statesmen, generals; but never of a born director. Some are never "fit." Trained directors can settle down to their work and go into the affairs of a new company in a style which would be utterly impossible for a scratch pack giving ever so much tongue. Will the new electrical companies lay on the scratch or the trained? The former will have to be blooded and hunted together before they are much use; and with the latter there is danger of cliquism. Nothing, we think, will be so disastrous to the industry as a ring. Competition and cheap markets will be as beneficial to the central station companies as stimulating to the manufacturing: ensuring in our opinion, the greatest profit to the greatest number, giving the choice of more improvements and inventions to the public, and more scope for the genius of electrical engineers than an electrical monopoly.

DANGERS OF ELECTRIC LIGHTING.

"THE time has now arrived when it is absolutely necessary for the public generally to clearly understand one or two matters connected with electrical science, and we propose to explain to the uninitiated, certain electrical terms, and, having explained them, to show what are the 'dangers of electric lighting,' whether a high tension or a low tension system is used." The foregoing are the opening words of an article in *Engineering*, by Messrs. Ferranti and Ince, on "The Dangers of Electric Lighting." These gentlemen have evidently taken fright at the succession of fatalities which have occurred in America and which have so alarmed the public, and feeling that the system on which they have practically staked their reputation is seriously menaced, they have come to the conclusion that they must uphold it at all hazards. The first portion of the article in question deals with a general explanation of the advantages of the high tension system in the economy which it effects by enabling small mains to be used; then the question of the insulation and the heating of the conductors is fully gone into. With reference to this, great stress is laid upon the fact that if an accidental contact causes a rush of current, a safety fuse will cut the current off before any damage is done. Safety fuses, we believe, will, sooner or later, be looked upon as barbarisms; gas companies do not cut off their mains with a safety valve, and electric conductors must be protected by making the generating plant regulate automatically. Arguing with reference to the calorific effects of the low tension system, the writers say: "We have seen that to do the same work, the low tension system requires 1,750 ampères against 17·5 on the high pressure, and thus, if an accident does happen on the low tension system, the immediate calorific effect of 1,750 ampères is called into play. Now, if on the high tension system such an effect could be reached, our engines would be called on to do an absolute impossibility, as they would be required to give 100 times their normal power before the quantity and equal heating effect of 1,750 ampères could be reached." To the general public, for whose benefit (?) the article is written, this will appear very sound logic, no doubt, but that Messrs. Ferranti and Ince could have penned the argument believing it to be sound we hesitate to accept; the conductor for high tension is only made to take 17 ampères, and a very little extra current would heat and melt it, whereas the writers make it appear as if 1,750 ampères would be required to do this. But, after all, why all this argument? Does it disprove facts; of the total number of fires that have been caused how many have been due to low tension and how many to high tension systems? We are told what damage the low tension system *might* do, but not what the high tension system *has* done. The article, we observe, is to be continued, and we shall be interested in seeing what further is to be said; the columns of matter already written by Messrs. Ferranti and Ince deal with a question which, although of importance, is *not* the one that has caused such a scare, though the tendency of the article is to make it appear as if it were. The question of danger to life, not from calorific but from physiological effects, is *the* question, and unless this can be satisfactorily dealt with, and we cannot imagine that any argument can prove that a low tension system is dangerous and a high tension one not, the whole of the first article is practically of little account. Messrs. Ferranti and Ince are trying to argue against facts, and facts are against them.

The Threatened Corner in Para Rubber.

AS we foreshadowed last week, it appears that the Companhia Mercantil, a Brazilian association organised by the well-known Count Viana, has at last obtained the exclusive handling of the Pará rubber trade, with the avowed intention of raising the price of that commodity. The Government, in granting the concession, seems to have swallowed the bait proffered it of an increase of revenue which, as the export duties are *ad valorem*, would follow the proposed rise in price of rubber. The quantity of Pará rubber annually exported amounts to between 10,000 and 12,000 tons, of which considerably more than half goes to the United States. That country will consequently be the greatest sufferer from the monopoly, and as a matter of course the loudest outcry against Count Viana's project proceeds from American merchants and manufacturers. Nor have the French raised a much less energetic protest against the scheme. The Provisional Government of the Brazilian Republic may of course annul the concession granted by the local government of Pará, but this is scarcely likely unless considerable pressure is exercised by either the United States or France, and it would be difficult to imagine what pretext for interfering could be found by either of these Governments. Many of our readers will remember that some years ago Count Viana, or as he is known in Brazil, Baron Gondoriz, organised a corner in Pará rubber which, after lasting for about eighteen months, resulted in the failure of the Baron for some £250,000. The cause of this particular collapse was, no doubt, the increased supply, brought about by the high prices in Pará, of other though inferior varieties, and it is quite on the cards that the same story will be now repeated. There are certainly many manufactures in which it is absolutely necessary to exclusively employ Pará rubber, but these may be said to form the exceptions, and it is evident that as the price of Pará goes up, the demand for it must decrease, while there will be a corresponding activity in the supply of other varieties, fresh sources being developed, and better methods employed in collecting. When referring to the development of the rubber trade in districts other than Pará, we would more particularly indicate the notable expansion of this business in Africa, a growth of trade which will receive an enormous addition of support from the action of the Companhia Mercantil. It is true that African rubber is much inferior to the Pará variety, but no doubt rubber manufacturers will show themselves equal to the occasion, and so far as a confiding public is concerned, why, "Where ignorance is bliss," &c. As to the much talked of, and in certain quarters, no doubt, eagerly desired, intervention on the part of the Government of either France, America, or England, the countries most interested in the rubber industry, we fail to see what excuse could be reasonably found for interference with the domestic concerns of another Power, unless, indeed, the fact of that Power being a weak one, prove a sufficiently satisfactory reason, an international code for which, however doubtful its morality, there is ample precedent.

The Art of Interviewing.

A REPRESENTATIVE of the *Evening News and Post* has been interviewing "a well-known official in electrical circles" on the subject of the dangers of electricity. The peculiarities of this well-known official, whoever he may be, seem to be, first, a penchant for taking off his spectacles and twirling them in his right hand; and, secondly, an utter disbelief in the reports of recent accidents from America. He does not deny that there *are* fatalities, but he thinks they are made a great deal too much of. He also informed his questioner that the various metropolitan companies were on the point of completing the laying of their underground mains, and when these were brought into use London will suddenly burst forth into light. This is all we can gather from a column of our evening contemporary's prattle, and the wonder to us is that officials, whether well-known or still involved in obscurity, should be found willing to flippantly answer all the silly questions put to them by reporters who seem to prime themselves with a few stock phrases generally having no real bearing at all on the subject under discussion. We defy anybody to gather from the well-known official's replies the slightest useful knowledge on the dangers of electricity; his most logical assertions are that matches, cigars, and gas will cause accidents if improperly employed. This, however, is somewhat stale news to the majority of mankind.

The Situation in New York.

NEW YORK streets are now practically without arc lamps. We are also informed that poles are being chopped down at the rate of 100 per day, and miles of wire thus being lost; this will bear somewhat heavily on the electric light companies. The United Electric Light and Power Company and the United States Illuminating Company have sent an open letter to the Edison Company of that city, accusing the officials of the company of spreading "grossly incorrect reports." A challenge is then offered for a full and careful investigation into the relative merits of the companies' systems. The United Electric Company expects, among other things, to prove by such enquiry that their conductors carrying high tension alternating currents, have been, and can be safely operated underground; that the system, as used by them, insures safety to the user of incandescent lights. It is also expected that the Edison underground system will be proved dangerous on account of leakages which might be held responsible for fire; also that the Edison business can only be rendered safe by the adoption of the converter or transformer system.

Argumentum ad Hominem.

THE arguments used by the advocates of high tension alternating currents show that, even if exceedingly dangerous, they are not more so than many other things with which we have to deal, are not always remarkable for sound reasoning. We use high pressure steam engines, they say, and engineers are not likely to reduce the pressure to 40 lbs. on the square inch, because very high pressures are likely to cause more explosions. The simile is scarcely applicable, because with steam we can certainly, to a great extent, see danger ahead. We have a safety valve, a pressure gauge, water gauge, &c., always under our eyes, and with a periodical inspection of boiler plates we can pretty well ascertain from time to time how matters stand, and so reduce the chances of danger to a minimum. With electricity how different is the case! We know what the voltmeter and ammeter indicate, and that is all. Even gas, notwithstanding the alarming frequency of fatal accidents from its use, is more under our immediate supervision, for an escape gives a very unpleasant warning of its presence, although at times it is unheeded. With electric currents we are dealing with a subtle influence which can neither be seen, heard, nor offend our sense of smell, and only too frequently is a leak made known by the sudden launching into eternity of an electric lighting company's *employé* or a too venturesome consumer.

Exhibitions.

WE give on another page a few particulars of the Frankfort Exhibition, which is to be held from the 1st June to October 21st this year. It is unfortunate that this year should have been decided on as the period to hold the exhibition, as it will to some extent clash with that at Edinburgh. In spite of this drawback, however, there seems every reason to believe that the Frankfort Exhibition will be one of considerable success, especially as we are assured by the promoters that the German Government and Chambers of Commerce have promised their hearty co-operation.

ON THE HEATING OF CONDUCTORS BY ELECTRIC CURRENTS.

By G. S. RAM.

MR. KENNELLY'S paper on the above subject is far the most important, from a practical point of view, to electric light engineers, of any which has hitherto been published. It is evident to anyone who has read the paper, that Mr. Kennelly has taken the greatest care in carrying out his experiments, and that the nature and conditions of the experiments are such as to at once render the deductions therefrom useful for ordinary everyday requirements, without having to afterwards introduce any uncertain or undetermined factors in order to make them of any service to the practical man. The fact that the experiments were carried out in the Edison laboratory in Orange ensured that all the instruments and apparatus used would be of the very best, and the experimenter would have every facility for conducting his operations in whatever manner he might consider most suitable. This would lend additional weight to the correctness of the results were it needed.

From a practical point of view, no doubt the first part of the paper, "dealing with insulated copper wires, encased in wooden panelling to represent house wires," is the most important at the present time, as there is now such an immense amount of house wiring about to be done; and any information which will enable electric light engineers to understand more fully than heretofore the proper way to wire buildings is doubtless very welcome.

From a long series of experiments on insulated empanelled wires, Mr. Kennelly has deduced the formula $d = \frac{\sqrt[3]{C^2}}{70}$ for obtaining the correct diameter of wire for any given current; taking as a basis the rule recommended by the committee of the Institution of Electrical Engineers, that with double the current the temperature shall not exceed 150° F. It is a curious coincidence that this simple formula, dealing with covered wires in panels, and which is the same as that which represents the law connecting current and diameter for bare wires in a vacuum, that is, subject to radiation alone, should just happen to apply in the case of the limiting temperature recommended by the Electrical Engineers' Committee; whereas it will not fit in with any of the other temperatures, for which a much more complicated one would be required.

Although, for this rise of temperature, Mr. Kennelly does not appear to have gone beyond about 180 ampères in the experiments, he has calculated from the formula a table giving current and diameter up to 1,000 ampères. It is satisfactory to note that up to 200 ampères this table indicates that a considerably smaller wire than that required by the old rule of 1,000 ampères per square inch is sufficient. Those, therefore, who have been during past years putting up wires by the old rule, may console themselves for their unnecessary outlay in copper by thinking how nice and cool their wires must be. Above 200 ampères a single solid copper wire or rod is seldom used. If it were, however, Mr. Kennelly's table shows that the diameter must be enormously larger than it would be at the rate of 1,000 ampères per square inch.

Does this rule, however, apply to the case of insulated wires, as used by the best firms in this country? Mr. Kennelly says, "In applying the rule for safety limitation as given by the table, insulated wires are, of course, to be understood, and no particular thickness or quality of insulation need then be specified." Now this may be correct enough for American made wire, which is always made in much the same way as that used and described by Mr. Kennelly, thus: "All the ordinary insulated house wires were covered, at the Edison Machine Works, with cotton soaked in a special insulating liquid." This sounds very much like the ordinary underwriters' wire, which is merely coated with cotton and run through a bath of paint.

Insulated wires are analogous to covered steam pipes. In the case of the latter, it is well known that a difference in the conductivity or thickness of the covering makes a vast difference in the rate of cooling of the pipe. The analogy, of course, is not complete, for if a wire carrying a current were covered with an absolute non-conductor of heat, its temperature would continue to rise indefinitely; whereas with a steam pipe it would not rise above that of the steam inside it. A steam pipe covered with felt or cotton loses less heat than if uncovered. A 4-inch steam pipe covered with felt 1 inch thick, loses only about one-sixth part of the heat it would lose were it uncovered; and if covered with a thickness of 4 inches, only one-fourteenth the amount. In order that a covered pipe might lose heat at a greater rate than if it were not covered, the covering material would have to have a conductivity for heat about ten times greater than that of felt or cotton. And it is a fact that many of the cheap mixtures used for covering steam pipes, boilers, &c., are worse than useless as they increase the cooling effect instead of diminishing it. India-rubber or gutta-percha have a conductivity for heat of only about four times that of felt. Therefore a steam pipe covered with India-rubber or gutta-percha (supposing for the moment that it would stand the heat) would be kept warm in the same way as with a felt covering, though to a lesser degree. Precisely the same thing would happen in the case of a copper wire covered with India-rubber, or gutta-percha, or cotton. In fact, Mr. Kennelly found it to be so in the case of a cotton-covered wire when white, though not when black. Had the covering of the black wire been thicker or more dense, the same would have been found to be the case with it also. The ordinary thickness and density of the cotton covering on a wire is not great enough to make the effect very marked. The air spaces are sufficient to allow of so much cooling by convection within the covering as to greatly reduce the effect. In the case of Mr. Kennelly's wires the "special insulating liquid" in which the cotton had been soaked, no doubt was a very much better conductor of heat than the cotton itself, and therefore the net result was that the covered wires kept cooler than the uncovered.

In this country, however, it is customary to use wires which have a coating of rubber on them, outside of which is a thicker cotton covering which may or may not have been soaked in some insulating liquid. It depends therefore on the nature and thickness of this outer covering, whether or not the wire will be heated or cooled by the insulation as a whole. Obviously then Mr. Kennelly's table and formula cannot be accepted as being applicable in the case of wires covered in the customary manner of this country, without, at any rate, further experiment. Even if the formula were found to be suitable the constant $\frac{1}{70}$ would have to be modified for different varieties of insulation.

Mr. Kennelly's experiments on bare wires are extremely valuable. The method of separating out the total loss of heat into its component parts of convection and radiation, and thereby showing that the radiation follows almost exactly the law given by Dulong and Petit, is very interesting. The statement that "the smaller the wire the greater the likelihood appears to be of the rate of emission falling behind the rate of rise of temperature," however, does not apply in the case of very small wires, as was shown on p. 669 of the last volume of this journal.

The experiments on bare wires out of doors are interesting, showing that with an almost imperceptible amount of wind the cooling effect is so great that twice as much current may be safely carried as in a still room. And owing to the increased ratio of loss of heat by convection to loss by radiation, the difference between the black and polished surface is very much reduced.

OPENING OF THE BUDA-PEST AND VIENNA TELEPHONE LINE.

[FROM A CORRESPONDENT.]

AFTER many unsuccessful attempts the "general trial" of this line, destined to connect the two capitals of the Austro-Hungarian dual monarchy was effected with full success. The first official attempts at conversation through the completed line took place on December 28th in presence of representatives of the Buda-Pest and Viennese press, and it may now be said that the technical difficulties concerning which I have already informed you are now completely overcome.

In accordance with the courteous invitation of the Minister of Commerce, the representatives of the Buda-Pest and other Hungarian newspapers met at the house of the Commissioner of Posts and Telegraphs, Herr Dionys Cimponiczu, where they were received, on behalf of the Minister of Commerce, by the Sectional Councillor Géza Szabó and the Ministerial Councillors P. Heim and Koloman Pfannschmid. The entire company then repaired to an inner court where the telephone office was temporarily set up in order that the distinct audibility of the words and sentences transmitted from Vienna might not be interfered with by the noise of the streets. In the court there had been fitted up three telephone chambers closed with doors, their walls lined with a non-conductor of sound. These chambers correspond with three telephone chambers in Vienna, two of which are at the central telegraph office in the Rennweg, whilst the third is at the Vienna Exchange. The telegraph rooms in the post office here are destined for the telephone service by day, whilst for the night service there is a special cell in the third storey of the post office.

The construction of the telephonic apparatus is perfectly identical with that in use in the metropolis for local intercourse. It consists of an electric signal bell, the ringing of which indicates the beginning of a telephonic conversation. After the traditional "Hallo" the receivers are applied to the ears, and the sender speaks into the funnel, which transmits the sound so clearly and distinctly that not only every word spoken is heard, but even the voice may be identified. Of the three telephonic lines, two act in an excellent manner. The third line reproduced the words accurately, but they are accompanied by a disturbing noise in addition to the words of the speaker in Vienna. This disturbance is ascribed by experts to a loss of current, a fault which is in course of being rectified. The first telephonic message was from a Vienna correspondent concerning the spread of the influenza in Vienna. A second communication gave the closing quotations on the Vienna Stock Exchange, which could be conveniently noted down upon a small desk, fixed close to the apparatus. For half an hour messages and replies passed between Vienna and Buda-Pest, and it may be stated upon the faith of such a communication that our Viennese friends heard as distinctly as we did. The Viennese Imperial engineers, Kareis, Trantsch and Granfeld, who represented the Ministry of Commerce at Vienna, finally wished us a happy new year, and thus the experiments came to an end. By the new year the telephone line can be thrown open to public intercourse; the exact date will be duly announced to the public.

As to the technical details of the Buda-Pest-Vienna telephone the following ministerial report has appeared :—

The line is laid along the Buda-Pest-Bruck-Vienna Railway and rests on posts distinct from the telegraph. The line consists of three double leads, which, in order to avoid the inductive action of the telegraph wires running on the other side of the rail, are stretched like the thread of a screw, so that if the six supports are viewed they seem to be fixed diagonally. In order to prevent the inductive action of the telephone leads upon each other and the consequent confusion of sounds, the wires belonging together are crossed so that they exchange their respective positions. This arrangement along the railway was proposed by the Hungarian experts, and it is the only installation in Europe which is carried for such a distance along a railway. The line is 262 kilometres in length, of which 220 kilometres are in Hungary and 42 in Austria. The posts are of pine wood, which, for the sake of durability, is saturated with a solution of sulphate of copper. As regards the other materials, the iron holders and the insulators (of native manufacture) are similar to those used for the telegraphs. The wires are 3 millimetres in diameter and made of silicum-bronze, as for such long lines iron is unsuitable on account of the occurrence of self-induction. Three lines were at once put up, on the one hand on account of the great amount of business expected, and, on the other hand, to provide against any interruption in the winter. In Buda-Pest three public stations have been erected, one at the Bourse and two at the Central Telegraph Office. The station at the Bourse can only be used by the members of the Bourse during business hours. Of the stations at the Central Telegraph Office, that on the ground floor is used only by day and that in the third storey only by night.

It is announced from Vienna that the trial between Vienna and Buda-Pest has given there full satisfaction. Among the official personages present were the Section Councillor Newbauer, on behalf of the Ministry of Commerce; Aulic Councillor Dr. Steiner, and the head of the Post and Telegraphic Department, Aulic Councillor Kamler, and the Director of Telegraphs Pilz. Of the personages invited, there were present the representatives of all the Vienna papers and of many Berlin and London journals, as also the correspondents of the Buda-Pest papers. The trial was perfectly successful. Every word was heard, and every voice with all its peculiarities. It must be remarked that the conversation was from one central station to the other central station. When subscribers speak to subscribers, the distinctness may be lessened, as it was shown on the Vienna-Prague line. The erection on behalf of Austria was conducted by the engineer Schwanzera, and on behalf of Hungary by the engineers Kolosváry and Bala. The cost of the Austrian portion (42 kilometres) was 30,000 florins, and that of the Hungarian portion (from Bruck to Buda-Pest), 250 kilometres, was 170,000 florins. The Austrians laid the line along the high road, and the Hungarians placed theirs along the railway. The former plan is preferable on account of the absence of noise. If the Vienna-Prague line is compared with that from Vienna to Buda-Pest, the former deserves the preference, as here only two wires run upon one set of poles, whilst on the Vienna-Buda-Pest line the same poles support six wires. Certainly, only two of these three lines have been opened for use, and in this manner the cost of the installation is smaller. It is an interesting fact, that a direct conversation has been held between Prague and Buda-Pest, and without the use of any auxiliary apparatus at the Vienna station. The wires of the two lines were placed in direct contact. This connection will not be opened to the public.

INTERNATIONAL ELECTRICAL EXHIBITION AT FRANKFORT-ON-THE-MAINE.

THE above exhibition is to be held from June 1st to October 31st. The committee of the exhibition have just issued the following particulars on the subject :—

In consequence of a proposition emanating from the Society of Electricians of Frankfort-on-the-Maine, a provisional committee has been formed to examine the question whether it was possible to organise an exhibition of electricity in that city in 1890. After much study, and taking into account the particularly favourable geographical situation of Frankfort, this committee unanimously decided to immediately organise the exhibition in question and to commence the preparatory works without delay. It is hardly necessary to say that the committee has not been able to undertake this mission without having previously assured itself of the support and assistance of the Government, the municipal authorities, the Chamber of Commerce, and other bodies. On every hand the idea of organising an electrical exhibition at Frankfort in 1890 has been received with the greatest sympathy. The enterprise being assured from a financial point of view, there is no room for doubt as to its success. Since the electrical exhibitions which were held at Paris in 1881, at Munich in 1882, and at Vienna in 1883, there has been no special exhibition, though it is precisely in the years which have since elapsed that the most remarkable inventions in the domain of electricity have been made and a flourishing electro-technical industry has been developed. It may be said that a special electro-technical exhibition supplies a veritable need. Thanks to its geographical situation, in the centre of travellers from the north and south of Europe, Frankfort appears particularly appropriate for the object we propose. As a large number of cities are, like Frankfort, occupying themselves with the introduction of the electric light and the transmission of power and its distribution at a distance, visitors from the whole world may be expected to flock hither. It is clear that, under these circumstances, exhibitors and inventors will find the best guarantee of success, as well as regards publicity as for the transaction of business. This prospect appears the better founded as the question of the site of the exhibition has been solved in the most satisfactory manner. We have obtained the assignment of land belonging to the State situated between the town and the new central railway station, having an area of 50,000 square metres, and which will be directly connected with the State lines of railway, so that the arrival and departure of articles for exhibition may be effected in the simplest and least burdensome manner. Thanks to the favourable conditions, the direction of the exhibition will be in a position to reduce to a minimum the expenses to be paid by exhibitors. The direction undertakes to supply exhibitors with sufficient motor power, and to obtain freedom from customs dues and transport facilities for exhibits from abroad. The exhibition will include everything which is connected with electricity so long as it be new or represent a notable progress compared with the special exhibitions of Paris, Munich, and Vienna. The exhibition will remain open from June 1st to October 31st. The exhibits will be divided into 12 groups as follows :—

1. Electric motors, steam engines, hydraulic motors, aeromotors, gas motors, as well as their boilers and accessories. 2. Production of electricity. 3. Means and processes for the distribution of electricity. 4. Accumulators and transformers. 5. Electrical transmission of power and its application to industry. 6. Electric lighting installations, &c. 7. Telegraphy and telephony, lightning conductors, electrical apparatus for protection from fire, thieves, &c., electric bells. 8. Application of electricity to railways, tramways, and ships. Electrical railway signals, &c. 9. Electro-metallurgy and electrolysis. 10. Electrical apparatus of precision, measurement, acoustics and optics. 11. Electro-therapeutics. 12. Publications relating to electricity.

We need hardly say we wish every success to the exhibition.

THE FRENCH TELEPHONES.

THERE is now, and has been since their acquisition by the State, considerable agitation regarding the French telephones and their working. The Government has been almost overwhelmed with complaints, regarding which a French contemporary says: Considerable discontent exists among the Parisian public, which at last sees that the question has been badly studied and badly understood, and that it is likely to become liable to feudalism, on account of the monopoly which has been demanded to satisfy State socialism. In reality, questions so complex as that of the telephones should not have been voted without study and unawares by a Chamber which was on the eve of expiry. As we (continues our contemporary) have not ceased to repeat, the Direction of Posts did not want more than two years to study a question which had been introduced to it at the beginning of 1886, and with which it judged it fit to occupy itself only during the course of 1889, without, in the interval, having considered it in any way whatsoever. To-day, now it is in possession of the monopoly, it is beginning to seek for the means to satisfy the public, and it is making special studies in foreign countries. The Director-General himself has been presiding at an enquiry made at Berlin, but we do not know the result of his labours. Whatever it be, since his return, after the study he was enabled to make of the German State commutators and tables, he has announced through the Press his intention of creating a central telephone bureau supplied with improved telephonic apparatus, which will allow of the suppression by degrees of the auxiliary bureaux, or, in any case, of only leaving one or two. This, in short, is the proposition made at the commencement of 1886 by the General Telephone Company, and from which Parisians would benefit to-day if the State had at that time come to a decision, as was its duty, because either the State would have been obliged to accomplish this change, or it would have made it compulsory. On this subject the Administration of Posts has just entered into communication with that of the Domains of the City of Paris, in order to obtain a position at a certain portion of the Bourse, where this central telephonic bureau would be installed. But, in order to arrive at this result, funds are necessary, and the Direction of Posts is not sufficiently supplied by the credit voted it for the purchase of the lines. The ten millions voted it are no longer sufficient, which was easily foreseen. The Chamber of Deputies is about to be asked by the Government, therefore, to pass a measure securing a credit of 5½ millions, which was presented to the Council of State during the late vacations, in order to assure the working of the telephones by the State. The law of July 16th, 1889, which ordered the purchase of the General Telephone Company's lines by the State, authorised the Government to borrow a sum of ten millions to cover the expenses of this purchase. The Government took possession on September 1st last of the telephone lines of the company, and on that date offered the General Telephone Company a sum of five millions out of the sum which would be definitely due to it after the litigation in progress was concluded. Lastly, the Administration spent 500,000 f. in order to form a reserve of wires so as to meet the new subscription demands likely to be sent in. Further, the Administration announces that it must have, beyond this 5½ millions, 50,000 f. in order to pay for the expired terms of the hire of telephone offices. The Commission of Credits recently examined these different demands, and, before coming to a decision, it decided to call M. Coulon, Director-General of Posts and Telegraphs. It wished to ask him, in the first place, to give precise indications as to the total amount which working the telephones by the State would cost. It wished afterwards to interpellate M. Coulon on the irregularities and defects of the telephone service which have provoked the complaints of the public. This taking over of the telephones by the State has necessitated different preparatory decrees, the result of different trials and a uniformity of preparation, which has had as a consequence a law action on the subject of the use of the sewers of the City of Paris. Up till September the telephone company had paid the City of Paris for the use of the sewers. The State replaced the company, and did not understand paying the City of Paris, and it called to its aid a law of July 28th, 1885, which it was careful, however, not to promulgate till February 12th, 1889, when it said :—"Telegraph and telephone wires, other than those of lines of general interest, may be established in sewers belonging to communes only after the opinion of municipal councils and in consideration of a rent if the municipal councils require it. A decree, in the form of a regulation of the Public Administration, shall determine the amount of this rent (paragraphs 2 and 3 of Article II. of the law of July 25th, 1885)." The General Telephone Company, dispossessed of its rights of working, rightly claimed the sums unduly collected by the city for the passage of its lines through the city's sewers. It is evident, in this question also, that it is the shareholders of the company who will be the victims, because the State will profit from the pending trial, and will so put off paying the rent, and thus will not have to ask the Chamber for new credits. It takes its text, in short, from the law of February 12th, 1889, by saying it has no rent to pay to the City of Paris for its telephone wires, which cannot be classed, in its opinion, in the category of electric wires subject to any tariff whatever. The Parisian telephone line is a line of general interest, because it joins directly with the telephone posts from the suburbs and the provinces. It is of general interest, because it is the State which works it, and, under these conditions, it is permissible for the administration to establish in the Paris sewers such a quantity of wires as it pleases without having on that account to pay the city the slightest indemnity in the way of rent. To this pretension, which would entail upon the municipal finances an annual loss of nearly 400,000 f., the representatives of the city made a very just objection: "Yes, you are the State, you are authorised to place wires in our sewers without paying us any rent. These wires serve mostly to place Paris in communication with the suburbs, provinces, and abroad; therefore, with rare exceptions, nearly all the telegraph network is of general interest, and you are authorised, by the law of 1875, to give us nothing in exchange for the service we render you. But can the whole of the telephone lines be assimilated to the telegraph lines? Does not the law create distinctions between the different telephone lines? Does not the most recent, that of July 16th, 1889, which authorised the purchase of the lines worked by the General Telephone Company, speak of 'urban telephone lines'? Does it not specify the employment of 'the products of each line thus created'? Such wording gives rise to no ambiguity; there are, consequently, urban lines and others which are not urban; these latter, or lines of intercommunication, connect the towns within themselves, and it is to these that the term of general interest must be attributed. But for the urban lines, if the public interest is in question, it is no longer general interest, but rather local interest, and under these circumstances the State cannot make a right prevail which it has not. It is not a question, they add, of withdrawing from the State the right of working the whole of the telephone lines of which it is and remains the owner in virtue of the law of July, 1889. The question is limited to knowing whether the State can or cannot gratuitously use the communal sewers, and, in our opinion, it cannot." On this subject an affirmative answer has been given, but if the State, fatigued by the annoyances which the working of the urban telephones has raised up, finds it more advantageous and agreeable to cede this working to a third party, the concessionary of a State privilege, might he not also use the communal sewers by acting in the name of a delegation of the Posts and Telegraphs Administration? In the meantime the General Telephone Company claims from the City of Paris a sum of 1,215,000 f., which represents the rent paid by it from 1885 to 1889. Primitively, this company lodged with the City of Paris, in order to have the right of occupying the sub-soil of the public thoroughfare, a rent which was 20 f. for the first 500 kilometres, and which rose progressively to 50 f. after the first 1,500 kilometres. Later on, in August, 1885, the basis of payment was altered, and the company undertook to give the city a tenth of the net product of the subscriptions. In 1886 a return took place to the kilometric tariff. The sums collected by the city were 103,000 f. for the second quarter of 1885, and 248,000 f. for 1886. In the following year the sum reached 330,000 f.; and lastly, in 1888, the last for which the detailed accounts have been published, the amount exceeded 378,000 f. The company punctually fulfilled its engagements up to the early months of 1889. But since then it has refused to pay any rent, and, in addition, it claims from the City of Paris the sums paid as and from the month of July, 1885, under pretext that the city had not legally the right to impose on it any rent whatever.

In order to show that the above are not the vapourings of a class journal we quote the following leader on the subject from *Le Soleil*, one of the leading Parisian daily papers, which it publishes under the heading of "Telephone and Telegraph":—It is sufficient, it is said, for the State to put its hand on anything for that thing to go on no longer, or at least to go on badly. We had, for instance, a telephone company which was certainly not perfection—perfection is not of this world—but which did its best, and endeavoured to do very well, as well as it was possible to do. That is understood—the interest of a company being to satisfy its customers and to listen to all complaints. The State laughs at complaints, and if it has become master of the telephones, be sure it has only thought of the question of profits. Not that it disdains money, certainly! do not think that. On the contrary, it is fond of it, for it wants much. But a good dose of *naïveté* would be necessary to imagine that monopolising the telephones was only a matter of speculation. The Director of Posts and Telegraphs, M. Coulon, who is now also director of the telephones, has given explanations as to a crowd of verified irregularities, but especially as to the slowness of communications. That was not seen, or at least was much less grave, in the company's time. How, then, have so many difficulties arisen as it were spontaneously, that is to say, on the next day? Is it necessary to attribute it to the reduction of prices? The stated imperfections were, however, the same yesterday as to-day. The State has taken the line as it was with its hiatuses and inconveniences. Why, then, in its hands is the working more defective? Is it that the central telephone *bureau* should be constituted into a sort of black cabinet in which certain conversations should be seized in passing and noted, so as to bear them to the knowledge of the State officials. But then the State itself has no right to put its eye to keyholes and its ear to the telephone. That is not done to produce disquiet, for the said State, composed of individuals who formerly protested with an indignation which it is permissible to look upon to-day as quite comic, marches on imperturbably in the ruts dug by those who then furnished such fine periods to the men who passed for the unalterable friends of every liberty. M. Coulon has spoken handsomely and done handsomely; there is no reason that the telephone service should any longer be bad under his direction than it was under that of the company. That there are many improvements to be introduced there is no doubt. It appears, even, that a commission, composed of competent men, is *en route* for America, so as to study on the spot a system more perfect than ours. And yet we willingly imagine that when ex-President Cleveland, or even one of his friends, demands a telephone communication, there are in all the offices precise instructions enjoining the *employés* not to have, on this occasion, their ears in their pockets. It is the same at Paris, where, in Governmental circles, the disease of suspicion is much more acute than the dengue fever in the populous establishments of the capital. What singular reflections it is permissible to make, when one looks back 20 to 30 years! Most of the men now in power struggled with extreme energy against all the proceedings of authority, and they were not wrong. The slowness of telephone communications, in certain particular cases, has no other plausible explanation, because, whatever the imperfections of the line, they are to-day as they were yesterday, without value as a serious excuse. The State has no right to be slower in transmission than the dispossessed company; it seems, on the contrary, that it should do better, were it only to justify its taking possession.

There is nothing of this, and the reasons given by M. Coulon are the more unsatisfactory that nothing hinders, nor can hinder, its *employés* from doing to-day what they did yesterday under the company's direction. But no, it is always the same : an incurable disdain of the public which pays, and, in addition, which is much more grave, the curiosity of private business. I wrote, in last Tuesday's *Soleil*, that a telegram closed at my address, left the preceding Thursday at the office at the Bourse, had not yet reached me eight days later ; the telegram is still travelling about, and the Administration of Posts, Telegraphs, and Telephones seems to have taken no notice of my legitimate complaint. It is possible, and I see no other way of explaining this bad case, that the director of the office at the Bourse may, by inadvertence, have kept this telegram, and that he was afterwards ashamed to send it to me, after circulation in this new-fashioned tube. Let us admit that a telegram of the kind may wander, it is possible, though difficult to imagine ; but, not to speak after complaint, that is what is most extraordinary. Let us put it down to the "influenza," and say no more about it. The director of the office at the Bourse may have been taken suddenly with the dengue fever, and M. Coulon pass his days and nights on his pillows, while my telegram goes through all the pneumatic tubes in Paris. In the times we live we must expect everything.

JEAN FRANCOIS DESPOINTES.

IT was with deep regret that we recorded last week the death of one who has been intimately connected with the submarine telegraph service during the last 35 years.

Mr. Jean François Despointes was born on the 4th of November, 1816, at Barfleur in Normandy, was educated at the College of Valognes in the same province, and came to England at the age of 20 in order to study the English language. In 1854 Sir James Carmichael (chairman of the Submarine Telegraph Company) offered him the post of translator to the company (which was then in its stage of infancy), and shortly afterwards he was nominated upon the technical staff as one of the under superintendents charged with the duty of supervising the *employés* and telegraph instruments. In 1858 he was made superintendent-in-chief, a post which he so worthily occupied without intermission until the late illness which resulted in his death. His last duties were in the service of the Post Office, having been taken over by the English Government department together with the rest of the Submarine Company's officers and *employés*.

After an illness of six weeks' duration he died of peritonitis on the 26th of December, and was buried at Kensal Green Cemetery, on the 31st December, 1889. He was followed to the grave from his residence, 16, St. George's Square, N.W., by his son and relations, together with a deputation from the Post Office, and numerous scientific friends to whom he had for many years been so kind and true-hearted friend.

Mr. Despointes took a great interest in all that related to scientific progress, and from his position in the Submarine Company, in which he held the position of electrician, he was constantly brought into connection with all inventors, or those desirous of making experiments upon submarine lines ; thus he greatly aided Sir Charles Wheatstone, Prof. Hughes, Dr. Muirhead, M. Baudot, and numerous others, in their experiments on these lines, and in 1864 he assisted in the experiments made by the Russian Government between Caucasia, and Valentia, Ireland.

He was a member of the Institution of Electrical Engineers, Electro-Harmonic Society, Society of Arts, and numerous other societies in England and France, such as the Société Internationale des Electriciens, Société pour l'encouragement des Arts, Manufactures et Commerce, Paris, and by his daily telegraphic intercourse with the Continental officials of the telegraph, he was widely known and esteemed abroad. In England he was well known, not only by the numerous inventors and scientific friends whom he had greatly aided in their researches, but by the whole electrical world in London who were accustomed to meet him at every meeting of the Institution of Electrical Engineers, who were all deeply impressed by the innate kindness and gentle-hearted manner in which he expressed his views.

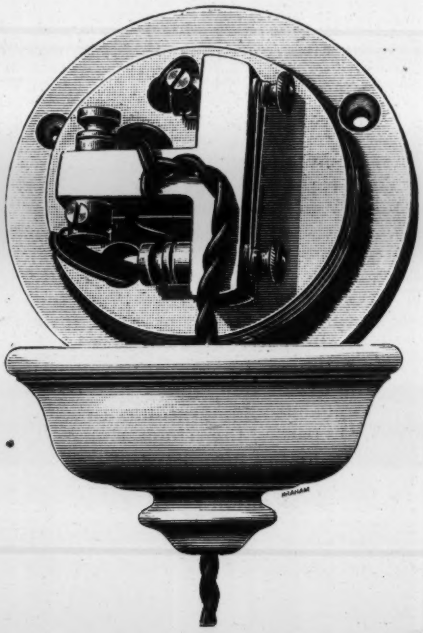
Mr. Despointes leaves behind him a sorrowing widow, son and two daughters. His son and son-in-law (Mr. Arthur Tite) hold high confidential positions in the house of Rothschild, and the whole family have long held a distinguished position both here and abroad. The loss to them will indeed be great, but it must be some consolation to them to feel that their sorrow is widely felt and shared by the whole telegraphic and electrical world.

D. E. H.

BINSWANGER'S PATENT HIGH INSULATION CEILING ROSES.

THE use of ceiling roses has become very general for electric light installations of every kind. Both in the factory and in the drawing room they are employed as the most convenient, safe, and artistic attachment of pendants to the mains. Since they were first introduced, like all other electrical fittings, they have had to undergo a great many changes, and to-day we expect a good ceiling rose to possess the following advantages :—

It should be fireproof, easily wired, strong enough for carrying weight, for which purposes no contact pieces should be used, should have plenty of room for a cut-out, and the whole construction so arranged that dampness of the plaster should not affect its insulating properties.



The illustration shows the latest type designed by Mr. G. Binswanger, and manufactured by the General Electric Company, Limited, which combines all these requirements.

On the top of the china base are T-shaped projecting walls, to which the terminals are fixed in such a way that no brass parts of any kind are visible at the back of the rose. Two holes leading through these walls are for the purpose of separating the flexible wire in the manner shown, thus making it possible to connect considerable weight to the ceiling rose, without strain on any of the contact pieces, while the wire is also separated at the base, so as to meet Mr. Heaphy's requirements. The terminals are very substantial, and there is 1¼-inch space for the cut-out, which is constructed for the use of tin or lead wires, with or without eyelets.

The rapid increase in the number of electric light central stations causes a proportionate increase in the demand for small fittings. More and more the success of an electric light installation will be dependent on these, and we are glad to notice that greater attention is being bestowed on them. We only hope that, as in America and on the Continent, manufacturers will combine to bring out a set of standard fittings, instead of each house producing its own types, a fact which has been detrimental to English competition in foreign markets.

GAS BATTERY.

By PAUL SCHARF.

THE purpose of this invention is the direct conversion into electricity of the energy contained in gases by means of the apparatus described below.

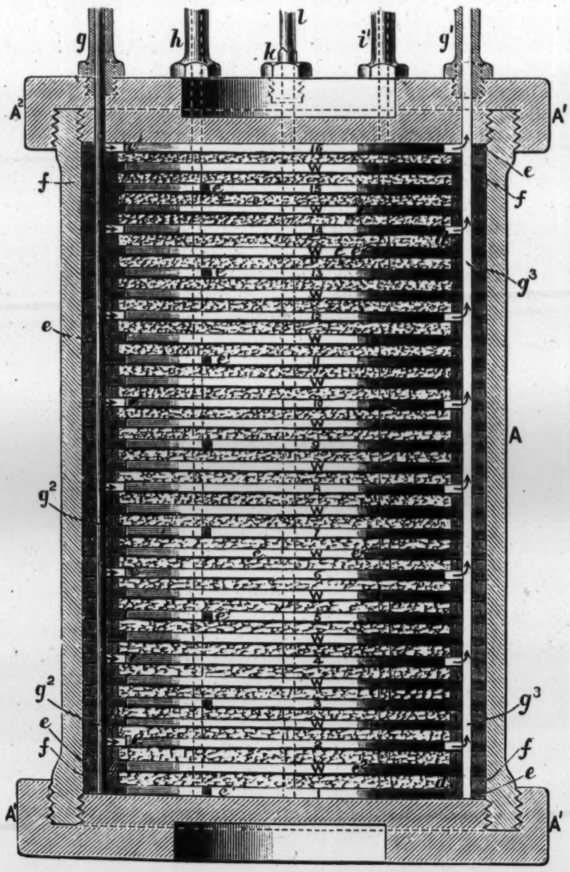


FIG. 1.

Attempts in this direction have already been made at different times, but all unsuccessfully, in part, on account of the unsuitable construction of the apparatus proposed, and in part from the use of the gases in wrong proportions.

All gases or vapours may be applied in pairs so that their reaction in a battery of suitable construction may yield an electric current. I use by preference either two gases, each belonging to one of the classes, *a* and *b*, or a gas and a liquid.

The gases may be: *a*, hydrogen, water gas, generator gas, coal gas, or all the vapours of the more or less volatile hydro-carbons of mineral oil, such as petroleum, gasoline, naphtha, &c.; and, on the other hand, *b*, air, oxygen, chlorine, fluorine, &c.

In the cases where I use a gas and a liquid, the one selected is used in place of a gas of the class, *b*.

Hydrogen peroxide (H_2O_2) or nitric acid is suitable.

The above-named gases of either or of both classes may (as described below) be used either in their natural state or compressed into a liquid, preferably water.

It is especially important that all the gases which I employ are not generated in my apparatus itself, but independently according to any known or customary process.

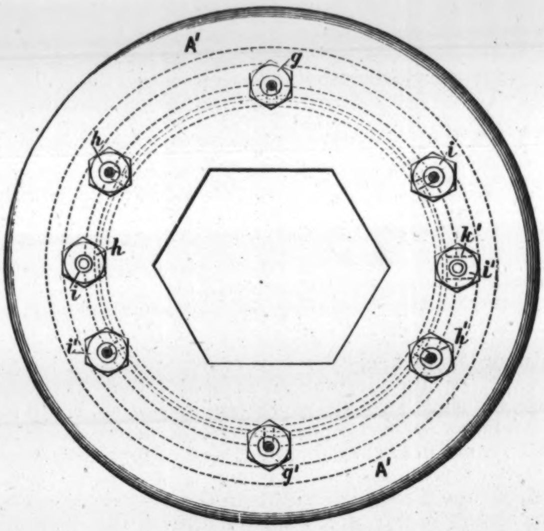


FIG. 2.

Two gases having the properties above-mentioned—*e.g.*, coal gas on the one hand and oxygen or air on the other—are generated or stored separately. Each gas is then forced into a special holder—a pressure reservoir—in which a pressure of any required height can be maintained as nearly constant as possible. The pressure is given to the gases by any known apparatus, pumps, &c., and preferably direct. Each of the gases is then passed under pressure into the battery or current generator to be described below, where they remain at equal pressure, and still separated from each other by the electrodes.

The pressure may be strong enough to liquify either or both gases, though this is not necessary for the result. Or the gases, or either of them, may be condensed in a liquid, such as water, and introduced into the cells.

Such a battery is shown in the accompanying figures, where fig. 1 shows a longitudinal section, fig. 2 an end view, and fig. 3 a plan and section of a single electrode with its contact.

The apparatus consists of a holder, A, preferably of metal, and of any desired form. I have given it here, as the most suitable, a cylindrical form. The holder, A, is provided with a bottom or cover, A', A', by means of which it can be closed hermetically, either with screws or in any other known and suitable manner. In this holder, A, are the cells, formed each of two electrodes, *c*, the latter forming an interval. As electrodes, I use porous carbon in plates or any other form; here, *e.g.*, they have the form of discs, to suit the receiver, A.

Each electrode, *c*, is enclosed by a metal ring, *d*, which is preferably (as shown in fig. 3), provided at one part with a projection, d^1.

This ring serves exclusively for securing a good contact for conducting the electricity into the two polar wires, and can, therefore, be replaced by a piece of any other conductive material of any other convenient shape, which can be connected with the carbon.

Any oxidation or formation of salt at the surface of contact of the ring, *d*, or its substitutes, arising from the penetration of the reagents in the porous electrode, may be prevented by closing the pores near the surface of contact with paraffin.

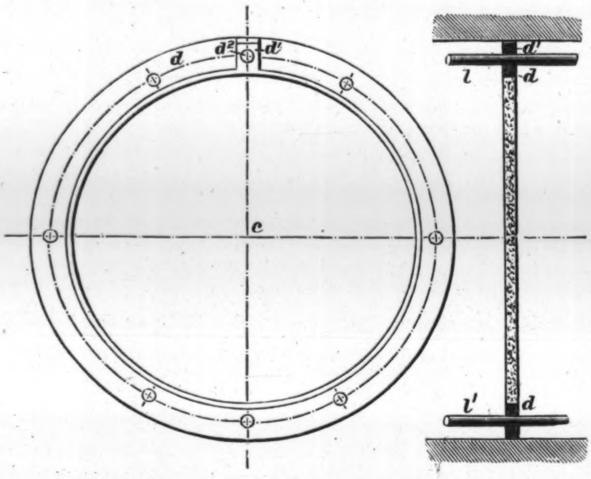


FIG. 3.

In order to keep the electrodes, *c*, at suitable intervals for the formation of cells, there is placed between each two electrodes an insulation, *e*, of hard caoutchouc, pressed paper, or any other insulating mass, which must fit accurately and closely into the recipient, A. After prolonged experiments, I have succeeded in finding a mass which fulfils in the best manner both purposes of the rings, *e*, *i.e.*, insulation of the electrodes and rendering the recipient, A, compact. It is asbestos. I use rings moulded of asbestos, or cut out of plates which have been already employed for similar purposes. The electrodes, *c*, which with their rings, *d*, are smaller in diameter than the internal diameter of A, and are also surrounded by insulating rings, *f*, of hard caoutchouc, or preferable of asbestos, fitting closely on the insulating rings, *e*. As it may be seen from fig. 1, a number of electrodes with their metallic divisions and insulating rings, form a series of cells separated from each other. Every alternate interval, W, *i.e.*, the space between every two cells is completely filled with a liquid conductor, for instance acidulated water.

These intervals, instead of being filled with a liquid conductor may contain porous non-conductive bodies, plates or discs in which the liquid conductor is absorbed and thus effects a connection between the electrodes.

All the cells of even numbers 2, 4, 6, 8, &c., contains one gas, and the odd cells, 1, 3, 5, 7, &c. the other. All the electrodes which form cells for the same gas are in conductive connection with each other.

The introduction and removal of the gases and the water into and from the cells is effected as follows: the cover or one end of the recipient, A, is provided with eight apertures. Of these, *g*, is the one gas inlet (*e.g.* hydrogen) and g^1 the corresponding outflow; *h* is the other inflow for gas (*e.g.* oxygen) and h'' the corresponding outflow; *i* is the inflow and i^1 the efflux for the acidulated water.

At *k* and k^1 are the two negative and positive polar clamps corresponding to the apertures g, g^1, h, h^1, k and k^1, all the insulating and tightening rings of the apparatus are provided with apertures which coincide with each other so as to form the channels, g^2, g^3, h^2, h^3, &c., through which the gases or the acidulated water flow in or out. Each of the insulating rings, *e*, is traversed inwardly by one of the influx or efflux channels, or provided with a notch, e^1 or e^2, by which is effected a communication of the channel in question with the interior of the cell formed by the insulating ring affected. Each cell and each interval has thus an influx and an efflux aperture, e^1 and e^2. The hydrogen —*e.g.*, here employed—is introduced at *g*, passes through the channel, g^2, and enters the cells, 2, 4, 6, 8, &c., through the apertures, e^1, e^1, e^1. It fills the cells and passes out through the openings, e^2, e^2, e^2, into the exit channel, g^3, leaving the apparatus at g^1. Here, as at the other efflux openings, h^1 and i^1, a pressure valve must be applied in order to regulate the flow. As such valves are well known articles of trade, they need not be here described. The filling of the cells, 1, 3, 5, 7, with the other gas and that of the intervals, *w*, with acidulated water are also effected in the manner just described. The electric conduction to the poles, *k*, k^1, is effected as follows:—

The projections, d^1, of the metal rings, *d*, or the connecting pieces in place of the latter, are perforated in such a manner that a metal rod, *l*, passes through each of these apertures, d^2, or rings, *d*, or through those of the substituted connecting pieces. The electric connection of the electrodes with the two polar clamps, *k* and k^1, is effected by means of the two metal rods, l, l^1, which proceed from the latter, pass through all the insulating rings in the apparatus, and are in contact with the corresponding electrodes by means of the projections, d^1, of the rings, *d*, through the openings of which they pass. The pressure at which the liquid conductor (*e.g.*, acidulated water) is passed into the intervals depends on the pressure of the gases in the cells; hence the influx and efflux of the water as well as of the gases must be regulated by valves.

The apparatus may be simplified as follows: Instead of using cells from which the gas passes into the electrodes the electrodes themselves may be connected with the gas inlet in the apparatus, so that the gases pass direct into the pores of the electrodes, which thus, in connection with the liquid conductor, produce the same effect as that of the arrangement above described. The cells 1, 2, 3, 4, 5 for the gases are thus dispensed with, whilst the position of the electrodes remains the same, since they are only separated by the intervals containing the liquid conductor.—*Zeitschrift für Elektrotechnik.*

LUCCA-LUCE ELECTRICA.

(FROM A CORRESPONDENT.)

WITH this heading, printed in red letters the size of a fist, there is circulating in Lucca and its neighbourhood a prospectus 1½ metres in length and 1 metre in breadth, and glaringly illustrated in red, green and gold. It invites the inhabitants of Lucca and the surrounding villages to connect themselves with the electrical works about to be erected for supplying Lucca and its vicinity with the electric light and motive power.

La Società—with this modest but inadequate name the new undertaking comes before the public—purposes, according to the prospectus, to arrange the installation for 10,000 glow lamps, and to obtain the necessary motive power (about 1,000 horse-power) from the river Serchio. What system of distribution of the current will be adoped—a conductor of several kilometres being necessary—the prospectus does not state, but a continuous current is probably intended since the prospectus, which indicates much, and is silent almost on everything, briefly mentions that the use of accumulators will afford full security against any interruption of the working.

La Società, this anonymous undertaking wrapped in such mystery, seems not to aim so much at filthy lucre as at the benefit of the subscribers. Such an intention appears at least from the prices at which the electric light is offered to the public.

An electrical current will be furnished to consumers at the following figures :—

For an 8-candle glow lamp	20 lire (=20 fr.) yearly
„ 10 „ „	25 „ „ „
„ 16 „ „	35 „ „ „

These prices are for the entire night, as we are expressly told in the prospectus, "from evening twilight to sunrise." The right of using the light for the whole night will probably be claimed by most of the subscribers, as the illumination of industrial establishments is placed chiefly in view. If we assume that the lamps on an average will burn for 2,000 hours yearly, the price of the light per lamp and per hour will run as follows :—

An 8-candle glow lamp	... ...	1 centime.
A 10 „ „	... ...	$1\frac{1}{4}$ „
A 16 „ „	... ...	$1\frac{3}{4}$ „

The price of the current for motive power is not quoted in the prospectus.

For introducing the lamps in the premises of subscribers the unknown company proposes to charge $16\frac{1}{2}$ lire per glow lamp, including the price of the lamp itself.

On the other hand, those who wish to take advantage of these favourable terms must lose no time, as subscribers who only come forward after the opening of the works will be charged 30 per cent. more.

According to the prospectus the installation will not commence until subscribers for 10,000 lamps have come forward.

PROPOSED CENTRAL STATION AT ASNIÈRES.

IN June, 1888, permission was granted to Mr. Détrez for the establishment of a central electric light and power station in the commune of Asnières, near Paris, and in September of the same year a similar concession was made to the Société pour la Transmission de la Force par l'Electricité. As the works have never been erected by either party, the concessions have been annulled; but the Société has now obtained further powers for the carrying out of the work, and which only await official approval for operations to be commenced. The company is empowered to lay underground cables, and also to carry wires overhead by means of iron posts about 20 feet high. The concession will date from the day when final approval has been given by the prefectoral authority, up to the end of 1910, but the company will not have a monopoly of the electric lighting, as the communal authorities reserve the right of conferring electric lighting powers on other companies, if necessary. This policy will, however, not be adopted during the first five years of the company's existence, which will be considered as the period of organisation, except in case the company should cease to make use of their powers. The concession will be void if the company does not commence lighting six months after approval has been given ; if any collusion takes place between the gas company and the electrical company, or if the latter delegates its powers to a third party ; and if the lighting should be discontinued for 14 consecutive days other than by legal interference. In case of forfeiture of the concession, the company must place the streets in the same condition as previous to the beginning of operations, and if such takes place during the first five years, the local authorities will, if desired, become possessors of all material installed in the streets without paying any indemnity to the company. The latter must conform to any regulations issued for the safety of the public, and on the termination of the concession, the communal authorities may acquire the whole of the plant, cables, &c., at a price to be determined by two experts, who, in case of disagreement, will be supplemented by a third party, to be appointed by the civil tribunal. The maximum charge for current will be ·05 centimes per carcel hour, or about $\frac{1}{200}$th of a penny per 9·6 candle-power lamp per hour. If the commune desire to have the electric light the price will be ·03 centimes ($\frac{1}{120}$th of a penny) per carcel hour should they do the internal wiring, and ·04 centimes if the company undertakes the wiring, whilst for arc lighting the charge will be ·02 centimes per carcel hour, the company doing the whole of the work. This latter will, however, only be the case for street lighting and where the mains are laid. Current for power purposes will be charged at the rate of 6d. for such quantity as is equivalent to a horse-power hour. Should any dispute arise between subscribers and the company as to the candle-power of the lamps, the efficiency or otherwise of the meters, &c., the differences are to be submitted to the municipal council for settlement. To facilitate the town control in this matter, the company is to instal in the mayor's office measuring instruments at its own expense, and if an arrangement cannot be arrived at the dispute will be referred to the courts having jurisdiction in the matter. In case of a disagreement taking place between the municipal authorities and the company, the dispute is to be decided by the Seine Prefect Council. A deposit of £64 10s. must be made by the company for each mile of underground cable to be laid.

It is evident from the foregoing conditions that the electric lighting company will not have a very happy time. To refer disputes regarding electricity meters to a town council for decision, is in itself exceedingly absurd, as we all know how intelligent municipal councillors are on technical matters. Far better would it be to have such disputes settled at the testing laboratory established in Paris a year or two ago, but the French electrical journals, including the *Bulletin International de l'Electricité*, which refers at length to the subject, make no comment on the matter. It may, however, happen that such disagreements will not frequently occur, so that operations will be carried on satisfactorily.

NOTES.

Electric Lighting in Shanghai.—The following particulars of the plant of the new Shanghai Electric Company, whose second ordinary general meeting is reported in our "City" columns, may prove of interest. There are now 90 arc lamps in use, with two No. 8 and three No. 7 Brush dynamos. There are also two 40 H.P. Tangye engines, one being always kept in reserve. The company is now intending to supply incandescent lights on the transformer system with Mordey's apparatus. Marshall's engines and boilers will be used, and the wire is to be supplied by Messrs. Clark and Muirhead. There are considerable difficulties to be overcome in introducing incandescent lamps, in consequence of the result of the Cleveland Brush Company's enterprise some three years ago in Shanghai. Still, the company has booked promised orders for 4,000 lamps, if the 800 which it now starts with prove successful.

Electric Lighting of Eastbourne.—The Town Council has refused its consent to the granting of a provisional order to the Eastbourne Electric Lighting Company, Limited, being resolved to do its own lighting within the borough, and to apply for the necessary powers in the forthcoming session of Parliament.

Electric Lighting of Torquay.—At a meeting of the Torquay Local Board, upon reading an interim report of the committee appointed to consider the question, it was decided that immediate steps be taken to prevent the acquisition by the Devon and Cornwall Electricity Supply Company, and the Municipal Electric Light and Power Corporation, of the provisional orders they have applied for, in anticipation of the Board deciding to undertake the lighting itself.

St. Pancras Electric Lighting. — The St. Pancras Vestry has instructed its engineer, Professor Henry Robinson, C.E., to prepare the necessary plans and specifications for a first installation of 10,000 private lights and 90 public lights, involving an outlay of about £60,000.

Lighting the Nizam's Territory.—Messrs. Siemens Brothers, of London, have offered to do the Municipal lighting of Chudderghaut, Hyderabad Deccan, for a yearly payment of 11,000 rupees. The present lighting is by kerosene lamps. It is calculated that the Municipality will save between 3,000 and 4,000 rupees by the change.

Electric Lighting at Tiverton.—Complaints are rife as to the inferior quality of the gas supplied to this town, and there seems to be a fair prospect of the new illuminant taking its place, as the Town Council are applying to the Board of Trade for a provisional order, empowering them to light the town by electricity.

Electric Lighting at Fareham.—Mr. Blake, the promoter of the Fareham Electric Light Company, attended a meeting of the Local Board on Friday evening, and applied for permission to erect posts and wires, &c., in the town, for the purpose of supplying the electric light. He said the company intended carrying out all the requirements of the Board of Trade. Some discussion ensued, but eventually the application was granted.

The Royal Society. — The following paper by Professor J. A. Fleming, was down for reading yesterday: "On Electric Discharge between Electrodes at Different Temperatures in Air and in High Vacua."

British and Foreign Patents.—A paper recently read at a meeting of the Institute of Patent Agents by Mr. G. G. M. Hardingham, entitled "The Relative Cost and Duration of British and Foreign Patents," has been published in pamphlet form.

The Phonetic Journal.—The first number of Isaac Pitman's weekly for the year contains, in addition to the usual full pages of shorthand with key, an article from the well-known phonographer Mr. T. A. Reed, on "How to Save 6,000 Years by Means of Shorthand," and the first of a series of articles on the "Newspaper World," both very interesting reading. There can be no doubt about the popularity of shorthand at the present day, and the future of Pitman's system seems to be pretty well assured.

Where?—The order for the electrical projections apparatus in connection with the fortifications on the Maas, Belgium, has been placed with Messrs. Schuckert and Co., of Nuremburg, in preference to the other competing firm of Sautter-Lemonnier, of Paris. This is regarded by a German contemporary as a real German "victory." *Invention* asks, "Where, then, were our English electrical engineers?"

Fires, Storms, and Overhead Wires. — The report comes from New York of the down-town station of the Edison Electric Lighting Company, comprising two four-storey buildings, having been destroyed by a fire which broke out in the dynamo room. News also comes from St. Louis, of a heavy rain storm which wrought considerable havoc amongst the electric wires. A horse and a dog were killed by stepping on a fallen wire, and several persons received severe shocks.

A Great Undertaking.—A scheme is on foot to utilise the water power of the great Kakabeka Falls on the Kaministigaia River, Ontario, for the establishment of smelting works, in which all the heat will be generated by electricity.

Copper in the United States.—A Committee of the National Electric Light Association has laid a petition before Congress, praying for the abolition of the copper duty.

Electric Railways in the States.—An attempt is being made, at Pittsburg, to organise a company with $5,000,000 capital stock, to be entirely devoted to the manufacture of appliances necessary for use in the construction of a new system of electric railroads.

Railway or Tramway?—At the Edmonton Petty Sessions, on the 5th inst., before the Divisional Justices, the Mines and General Telpher Company, Limited, were summoned for keeping five carriages without licenses. The defendants are the proprietors of an electric tramway used for carrying passengers from the entrance of Alexandra Park to the doors of the "Palace." The proceedings were taken under 32 and 33 Vict., cap. 14, sec. 27, which defines a carriage as "any carriage (except a hackney carriage) drawn by a horse or mule, or horses or mules, or drawn or propelled along a road or tramway, or elsewhere than upon a railway, by steam or electricity, or any other mechanical power." For the prosecution it was contended that the words "or elsewhere than upon a railway" were specially introduced because railways were already taxed, and the defendants in this case did not enter the defence that they paid railway duty. For the defence it was said that the defendants considered that their line was a "railway," and it was contended that in any case the cars did not come under the definition of a carriage, because they did not ply for hire, and could not be stopped, like a tramcar, between the fixed stations. The Bench found that the cars did not come within the definition of a carriage subject to taxation, and that it was a sufficient reason of exemption that they ran on rails, though it was not a statutory railway. This decision, it was intimated, will be appealed against. It was stated on behalf of the defendants that there was no intention to avoid liability; all they wanted was to know what they were really liable for.

The Revenue from Telegraphs.—In 1889 the receipts from the telegraph service of the United Kingdom were £2,255,000, or £215,000 better than in 1888.

China Waking Up.—Two Chinese gentlemen, representing a wealthy syndicate of Chinese merchants, are now in New York trying to arrange contracts for the electric lighting of some of the largest cities in China.

Electric Locomotives for London. — The electric locomotives now being built for the City and Southwark Subway have, on trial, proved to be capable of moving the loaded trains at a speed of 25 miles an hour with ease; and a higher speed could be attained if desired.

Accident to a Submarine Cable.—It is rumoured that the telegraph ship has broken the cable in laying it between Zanzibar and Mombasa.

Alarm in a Theatre.—At the Comédie Française, a few evenings back, some alarm was caused by the appearance of smoke rising up from the footlights. It was during the performance of "Hamlet," and M. Mounet Sully, who was at the time invoking the spectre of his father, had to retire and give place to the iron curtain, which was promptly lowered. It appears that the contact of two electric wires had communicated sparks to the gutta-percha insulating envelope, and thus caused an amount of smoke and a disagreeable smell of burning.

Royal Institution Lectures.—Prof. Rücker continued the series of lectures on electricity adapted to a juvenile auditory on Saturday, Monday and Thursday.

Subsidiary Company.—It is said that the Electric Construction Corporation has agreed to sell to the Foreign and Colonial Electric Company its foreign and colonial patents for the sum of £85,000, or £50,000 more than it originally paid for them. The working capital of the new company is said to be already subscribed.

Lights Out.—We hear that the electric lamps at the Gaiety Theatre failed a few evenings ago, as did those at the St. George's Club, Hanover Square. Both, we believe are supplied by transformers.

Insulation v. Voltage.—We have previously mentioned the breakdown of the Siemens cables under the high voltage which Mr. Ferranti persists in using; now we are informed that the Fowler-Waring conductors have suffered the same fate.

Prizes Awarded.—The Académie des Sciences has awarded the Prix la Case to M. Hertz, for his experiments in electric induction. The Prix Montyon has been awarded to Dr. d'Arsonval, for his later researches in electro physiology, including the origin of the electric variation of the muscles.

Mr. Mackay's Munificence.—Every employé of the Commercial Cable Company, received a Christmas present of a half-month's pay in advance. Over three hundred men and boys were made participants in this handsome gift, which, amounted to $15,000, and was made from Mr. J. W. Mackay's private funds.

Edinburgh International Electrical Exhibition.—The Executive Council have decided to finally close the list of applications for space on the 15th instant, when allotment will be proceeded with. The French, Italian, and Austrian exhibits are expected to be specially fine; while India, China, and Japan will all be well represented in the department devoted to general industries. The Railway Machinery and Appliances Section promises well, several of the leading railway companies having agreed to exhibit, while amongst the electrical exhibitors are Sir William Thomson, Mr. W. H. Preece, Mr. Edison, the General Post Office, Edison-Swan Company, Laing, Wharton and Down, Brush Electrical Engineering Company, Paterson and Cooper, United Electrical Engineering, King, Brown and Company, Muir, Mavor and Coulson, Sir William Vavasour, Limited, Elmore Copper Depositing Company, Thomson-Houston Welding Company, Newall Engine Company, Robey and Company, Electric Traction Company, Ernest Scott and Company, Ronald Scott, Woodhouse and Rawson, Buller, Jobson and Company, W. T. Glover and Company, National Telephone Company, Consolidated Telephone Construction Company, Electric Traction Company, Colonel Gouraud, Gent and Company, Exchange Telegraph Company, Eastern Telegraph Company, &c. The Decauville Company propose to show a narrow gauge railway in operation, but worked by electricity in lieu of steam. The Executive Council has arranged with Immisch and Company for a ten-minute service of electric launches on the Union Canal between Fountainbridge and the Exhibition, which will afford the public a novel and interesting mode of conveyance, and will probably constitute the first example of electric navigation for general traffic. In addition to the British electrical contingent, about 150 electrical exhibits are expected from France, where the Government has officially recognised the Exhibition, and considerable numbers from other foreign countries. The financial prospects of the Exhibition are regarded by the Finance Committee as eminently satisfactory, for, owing to the much larger sums obtained for refreshment and other concessions above those received at the former Edinburgh Exhibition of 1886, it is considered that the whole cost of the buildings, grounds, and preparations will be defrayed without drawing on the admission receipts at all, whereas in 1886 no less than £22,000 had to be made up out of admission receipts before anything was available wherewith to meet working expenses.

Copper.—Messrs. Fredk. Smith & Co. inform us that their price for high conductivity copper wire has advanced ¼d. per lb., making the present basis price 0 to 20 8¾d. per lb.

Obituary.—Mr. Charles Lever, the well-known electrician, left Altrincham on Saturday to visit his father, Mr. Ellis Lever, at Colwyn Bay, who has been ill for some days. Mr. Charles Lever retired to rest about 11 o'clock, and on Sunday morning his father, becoming alarmed when he was informed that no answer was returned when called by the servants, had the door, which was locked, broken open, and found his son had passed away during the night. The cause of death is believed to be an affection of the heart. The deceased was born in Gorton, in Manchester, February 15th, 1862. He was well known in the electrical world, and rendered excellent service as an inventor and discoverer. He was a member of most European and American electrical societies, and held a diploma from her Majesty's Government for his services in connection with the London Fisheries Exhibition. Mr. Lever was best known for an arc lamp, with which his name had been associated for many years, and in connection with several other patents for electric light apparatus, dynamos, and telephones. He contributed for some years to the pages of the ELECTRICAL REVIEW, and it is with deep regret that we record the death, at the early age of 28, of one who took so great an interest in the electrical industry.

Trade Note.—The tendency of the times is to combine the gas and electric lighting branches of trade. The latest to adopt this policy is the firm of D. Hulett and Company, Limited, of 55 and 56, High Holborn, W.C., who are well-known gas engineers. They have now undertaken the manufacture of electroliers and other fittings for electric lighting, and will also put up electric light installations complete.

A Fact.—Friday morning (an electrical engineer's breakfast table, near Wigmore Street).—E. E.'s wife, after studying our contemporary's supplement: "Are the Manchester Square Station and the Sardinia Street Station open yet?" E. E.: "Yes, why?" E. E.'s wife: "How very convenient for Drury Lane to-morrow! We shall only have a short way to walk. I suppose we can book through?"

Damaging Telegraph Insulators.—On Monday, at Hebburn Police-court, Northumberland, a boy named Charles Taylor was fined 5s. for damaging telegraph insulators by throwing stones at them. Mr. Humble, who attended on behalf of the Post Office, said that on a short line between Whitemare Pool and Tyne Dock there were 180 insulators broken during 12 months.

A New Theory of the Circulation of the Blood.—According to an American physician the motive power of the blood is not the hydraulic action of the heart, but electricity. The lungs are kept continually positive by the oxygen or electricity of the atmosphere, and the impure blood coming from the extremities of the system in a negative condition is made pure and positive; but as the law of electricity is that two positives must repel one another, the blood is forced from the positive lungs to the heart, and thence over the system. The heart regulates the system precisely like the pendulum of a clock, but gives no motive power. The worthy doctor is surely a candidate for the handiest asylum for idiots.

Electricity in Surgery.—Dr. Thomas Keith in the *British Medical Journal* is a warm advocate of electricity for the treatment of uterine tumours. He considers it preferable to hysterectomy, which gives a high mortality, although the disease itself seldom shortens life, whereas electricity relieves the patient of all troublesome symptoms. However, as this method of treatment is not without danger, even in the hands of experts, Dr. Keith insists that the surgeon should not merely "get up" his case, but should be well up in the science of electricity. Two cases are reported in the *Journal* as having been successfully treated by electricity.

Telephone Companies and Public Thoroughfares.—The St. Margaret and St. John's Vestry have refused the National Telephone Company's application for sanction to the opening up of Bridge Street, Tothill Street, and Broad Sanctuary, for the purpose of laying down pipes to carry telephone wires, on the ground that the public ought not to be subjected to inconvenience for the speculative purposes of a company having no statutory authority, and against whom the Vestry might have no remedy in case of accident or damage.

The Wimshurst Electrical Machine.—Sir A. Campbell, of Blythswood, has two machines in his private laboratory, and some recent experiments made by him in conjunction with Mr. J. T. Bottomley, illustrate their enormous power; one of them, we learn, giving a potential estimated at hundreds of thousands of volts. When a lighted candle is brought near one of the conductors of the machine it is blown out by the air currents due to the electrification of the atmosphere in its vicinity. When the conductors are terminated by polished metal balls the candle is blown out near the positive ball, but not near the negative one. Indeed, the smouldering wick can be relighted at the latter by the negative sparks drawn down to the wick through the column of smoke ascending from it. The positive ball seems quite unable to rekindle the flame.

Another Danger.—A circular issued by Mr. Edward Atkinson, president of the Boston Manufacturers' Mutual Fire Insurance Company, calls attention to a new source of danger to cotton in transit, of fire by spontaneous combustion generated by reason of the fibres being saturated with cottonseed oil. This is interesting. as cottonseed oil is now much used for insulating cables enclosed in lead.

Buckingham Electric Light Company (in Liquidation).—Creditors of the above company are requested to send particulars of their claims to the liquidator, Mr. Henry Thorpe, of 18, Chandos Road, Buckingham, before the 15th day of March, 1890.

What we may Expect.—The question has been asked, "Does electricity affect the climate?" An observer of the course and prevalence of the present influenza epidemic answers, "Yes." He has noticed that the complaint is more widespread and malignant in places remote from the sea coast, where there are no fresh breezes to neutralise the baneful change produced in the atmosphere by the increasing use of artificial electricity. He opines that London will not suffer in the same degree as some of the Continental cities, from the fact that electricity is only used to a comparatively small extent. From former observations made during the years when cholera made its worst ravages, it was seen that the electrical intensity of the atmosphere was much less than in other years, and so soon as the electrical intensity rose the fatality of the disease began to diminish. Influenza followed in the epidemical form. This second complaint, he considered—in which opinion he was corroborated by the author of a paper read at the British Association—was produced to a large extent by the presence of ozone in excess. "An observer" imagines, in consequence of the rapid increase of working electrical plants, that the air of our towns will become so overcharged with ozone that influenza and catarrhal affections will stay with us from one year's end to another as a perpetual epidemic, while our climate must necessarily deteriorate.

Slightly Erroneous.—A contemporary last week published a tabulated statement of electric tramways in the United Kingdom. Several stated to be in operation have ceased to exist. In another place is given a list electric lighting stations in progress, one of which, our knowledge, has been regularly supplying current for some years.

The Wrong Tint!—The "choppers" of New York hacked down a pole that was properly located and its wires all right, giving as a reason that the pole was not painted exactly the right tint!

Chaotic New York.—Fog, rain in driving sheets, with roadways and pavements a vast sea of slush and slop, are evils sufficiently trying and vexatious, but when, in addition, the picture is further blackened by the absence of the ordinary street illumination, and by the knowledge that there is an open trench at his feet to engulf the passer by, no one can fail to commiserate the lot of the unfortunate inhabitants of a city afflicted with so many direful plagues, nor can the victims be blamed for venting their spleen by a passing growl. The New Yorkers' experienced this combination last December, immediately after the recommencement of the wire crusade. All the arc companies had shut down, the gas lights in the streets were barely visible, and the fog was at its thickest, between 5 and 6 p.m., when the homeward traffic was at its greatest. This deprivation of the usual electric lights, and some excavations here and there for the construction of subways, rendered the homeward journey of the enormous and mixed traffic somewhat difficult and perilous. On that particular night the public would have willingly run the chance of an accident to have had the arc lamps in full working order again.

Lectures on Electrical Technology.—In order that Prof. Ayrton's technical course of lectures to the second year's students of the Central Institution may be attended by professional men and others, the hour has been changed from 10 to 11 in the morning to 4 to 5 in the afternoons of Monday and Wednesday. The subjects of the course for the spring term, commencing on the 15th inst., embrace:—Accumulators, construction, testing, storing capacity, output, life. Electric lamps, arc and incandescent, construction, regulation, testing, efficiency, life. Introduction to the study of transformers, direct current, alternate current, testing, power, efficiency. Electric traction with accumulators, with a stationary conductor, absolute block, telpherage. The distribution of energy electrically. Practical use of accumulators and transformers in electric distribution. Comparison of the various systems of distribution and their relative advantages. Electric lighting by the parallel, series, and parallel-series systems.

The Pacific Cable.—We learn that H.M.S. Egeria has been taking soundings along the route of the proposed cable across the Pacific, between British Columbia and Australasia. The Egeria left Sydney in April last, and en route to Auckland, the greatest depth reached was 2,800 fathoms, and the least 496. Between Auckland, Tonga and Samoa, the deepest known soundings obtained by an English ships was taken—viz., 4,530 fathoms. From Samoa to Tonga the soundings varied from 837 fathoms to 2,006 fathoms. It is expected that the survey will be continued in the course of the coming spring and summer. The matter is being watched with the greatest interest in Canada and Australia.

Lectures to Science Teachers.—Prof. Ayrton commences at the Central Institution, on Saturday the 25th, a course of nine lectures for teachers of public elementary schools, on the fundamental principles of electricity and magnetism, with their practical applications. This is done with the object of getting the teaching of elementary physics introduced into schools. The lectures will be delivered on Saturdays at 10 a.m., and in the following sequence:—The Electric Current, Electroplating and Electrotyping; The Single Needle Telegraph Instrument, Electric Sparks, Electric Current Generators, Electric Lamps, Storage of Electrical Energy, Electromotors, and Dynamo Machines. The lectures will be fully illustrated by experiments, and students attending the course will be allowed to repeat them.

Threatened Strike.—We are sorry to see it stated that a strike is imminent at the works of Messrs. Greenwood and Batley, Leeds, one of the largest engineering establishments in the country. The dispute appears to have arisen on the question whether a certain man put to work at the lathe was a skilled or an unskilled workman. The company employs about 2,000 hands, all of whom have given in their notices.

The Board of Trade on Electricity.—We commend to the notice of our readers the draft rules and regulations prepared by the Board of Trade, and given on another page, for ensuring a proper supply of electrical energy, and securing the public safety. It appears to us that quite a number of clauses are open to dispute.

New Company.—Messrs. Fowler and Lancaster have turned their business into a registered company, with a capital of £22,000. Our information came too late to take its place in the columns devoted to such purposes.

Rating Appeal.—The South of England Telephone Company appealed against the rating of the parish on Monday last, at the Brighton Quarter Sessions. After long arguments by the counsel on either side, the Recorder reserved his judgment until next sessions.

The Institution of Electrical Engineers.—Dr. John Hopkinson's address last night was on the subject of "Magnetism." As the paper is illustrated by figures, which have not come to hand, we must let its publication stand over till next week, when we can give it in its entirety; indeed it would be injudicious to spread it over two issues, for the address is of such a nature, that when once commenced the reader's interest is sustained to the end.

Electric Lighting at Keswick.—The local company commenced supplying the current on Monday last.

The Electric Lighting of Kensington.—Our readers will see from the advertisement printed in another place that the Notting Hill Electric Supply Company, Limited, has obtained the necessary powers for supplying electricity for all public and private purposes in an area within the Parish of St. Mary Abbott's, Kensington, about a square mile in extent. A provisional site for a central station has been secured at Victoria Gardens, Notting Hill. The light will be supplied entirely by underground mains, at one constant pressure, and the tension will be so low as to be free from danger to anyone who may chance to come in contact with the wires. It is estimated that for supplying sufficient current over an area in which 50,000 lights have been fixed, the plant can be erected for £67,000, and that the nett profit per annum will be £13,000. The capital of the company is £100,000 in 10,000 £10 shares, including 550 founders' shares. The chairman of the company is Mr. Wm. Crookes, F.R.S., vice-president of the Chemical Society and of the Institute of Electrical Engineers.

The Electric Lighting of Westminster.—The London Electric Supply Corporation, and the Westminster Electric Supply Corporation, are both empowered to lay mains in Victoria Street, Westminster. To minimise the inconvenience caused by the interference with pavements and crossings, the former company was recently sounded by the vestry as to its willingness to wait until the other company is ready to commence work. This it declined to do, on the ground that it might mean a delay of months. The London Company's mains will consist of a concentric cable covered with two sheathings of steel, flexible, quickly laid, and only requiring to be placed 4 inches under the flagstones, but the other company proposes putting down a brick or concrete culvert, requiring a trench of considerable size, and which will take time to construct.

Electricity in London Street Cars.—This is the title of a long article in Thursday's *Daily News*. It deals mainly with the Electric Traction Company's work on the North Metropolitan line at Canning Town. One curious piece of advice is given to anyone who wishes to parley with the foreman in charge of the company's premises, and this is to take a month's good hard grind at De Tunzlemann's new book on electricity. A glance at our review of this work in last week's issue, will show the value of the Newspaper scientist's advice.

Electric Lighting in South Wales.—To demonstrate the great strides which electric lighting is making in popular favour we may mention that Mr. J. C. Howell, of Llanelly, has, within the year 1889, installed 65 arc lamps and over 3,500 incandescent lamps in South Wales, besides other electrical work, such as electrical transmission of power for pumping plants in the Rhondda collieries, &c.

The Brush Electrical Engineering Company, Limited.—The chairman, vice-chairman, and directors of this company celebrated its tenth anniversary by inviting its friends and competitors to a banquet at the Hôtel Metropole on Monday last. The entertainment was in the best style of that favourite establishment, and as the *élite* of the electrical world was assembled it will easily be understood that a most enjoyable evening was spent. After the usual loyal toasts had been honoured, Lord Thurlow, who presided, gave that of "The Learned and Scientific Societies," to which Sir F. Abel responded; then that of "The Electrical Industry," responded to by Sir J. Pender; after which Sir F. Bramwell proposed the toast of the evening, "The Brush Electrical Engineering Company," to which Mr. J. S. Sellon, in the unavoidable absence of his Grace the Duke of Marlborough, replied. We may mention that the proceedings were enlivened by an agreeable performance of music by a select orchestra, under Mr. J. Pougher, and may express the hope that the success of the company will warrant the repetition of such pleasant gatherings at less intervals than those of ten years.

Fatalities from Electric Lighting. — Since 1880 electricity has been more fatal to human life in the one City of New York than in the whole of this continent. In Europe about 16 lives have been sacrificed to the 22 lost in New York during the same period. The following is an epitome of the European fatalities so far as we have been able to gather information :—

Date.	Victims.	Place where killed.	Cause of death.
1880	Mr. Bruno	Aston	Jablochkoff alternating current
,,	A stoker	Yacht, Livadia	Jablochkoff alternating current
1881	A workman	Hatfield	Brush current under 800 volts
1883	Railway official	Pesth	Ganz alternating current
1884 ,,	Emile Martin Jos. Kenarec	Tuileries Garden, Paris	Siemens 12-light alternator
,,	H. Pink	Health Exhibition, London	1,000-volt Hockhausen machine
,,	W. Moore	Middlesborough	Arc light plant, high voltage and bad insulation
1887	R. Grove	Regent Street, London	Alternating current Grosvenor Gallery
,,	J. Williams	Bisca, Wales	Shock from electric lighting wire
1888	A workman	Terni, Italy	Alternating current
,,	A carpenter	Valladolid, Spain	Alternating current
,,	An attendant	,, ,,	Killed trying to save his companion
,,	E. A. Richardson	Consett Iron Works	Current from arc light plant
,,	A workman	Brighton	Touched a live wire on roof of brewery
1889	I. Connelly	Siemens, London	Alternating current of 1,000 volts

Recent Interruptions and Repairs to Submarine Cables and Land Lines up to 25th December, 1889 :—

Section.	Interrupted.	Repaired.
Cable.—Rio Grande do Sul e Montevideo	4th Dec., 1889	6th Dec., 1889.
„ Brest and St. Pierre Anglo-American Company ...	18th Nov. „	12th „ „
„ Fanæ and Calais	27th „ „	16th „ „
„ Trinidad and Demerara ...	19th Dec. „	Still interrupted
Landline.—Saigon and Bangkok	30th Oct. „	13th Dec., 1889.
„ Moulmein and Bangkok	13th Dec. „	16th „ „
„ Indo-European	16th „ „	22nd „ „

Encouragements to Ingenuity.—The Leven Shipyard Awards Committee—under the scheme inaugurated by the late William Denny, whereby awards are made to workmen in the employ of the firm for inventions or improvements suggested by them—has issued its tenth annual report to Messrs. William Denny and Brothers. The report shows that during the present year 33 claims were received and considered by the committee. Of these 17 were found worthy of award, 15 were rejected, and 1 deferred. The sum given in awards during the year amounted to £106. A similar scheme is in operation in Messrs. Denny and Co.'s engine works, Dumbarton. Their report shows that 7 claims were considered during the year, of which 3 were found worthy of award and 4 are postponed for further consideration. £11 has been paid in awards.

Incandescent Lamps in Submarine Work.—Electric lighting has been found very useful in diving operations connected with sunken vessels in the neighbourhood of Chicago. The lamp was sealed up in a small glass jar, the wires, which were run directly from the poles of the dynamo, being passed through a watertight cover, and wound about the diver's air tube until they reached his helmet, sufficient slack being left to allow of his handling the lamp with ease.

The British Water-Gas Syndicate.—The internal differences of the syndicate appear to have been settled by the retirement of all the members of the board, with the exception of the Messrs. S. and W. Fox, and the appointment of three new directors. The syndicate has secured two large contracts for the erection of water-gas plants from two of the largest iron and steel works in the United Kingdom.

Government Employés and the Public.—An anonymous correspondent of the Paris *Figaro* inveighs bitterly against *téléphonistes*, and demands the substitution of a staff of men who would have a keener appreciation of the important nature of their duties. It appears that, in the old days, when the service was in the hands of the Société des Téléphones, the discipline was such that it "prévenait toute fantaisie de la part du personnel féminin." When, however, the telephones passed into the hands of the State, this discipline became relaxed, and the *téléphonistes* adopted the off-hand airs of other Government *employés*.

The Trade in Shellac.—The shipments from Calcutta for the season (November, 1888, to October, 1889) amounted to 55,807 cases, of which 35,844 cases were shipped to the United Kingdom, 2,710 to the Continent, 16,410 to America, and 343 cases to other parts. These were smaller shipments than in any season since November, 1879—October, 1880.

Dissolution of Partnership. — The partnership hitherto existing between E. D. Chester and T. T. Gibb, known as Chester and Gibb, of Johannesberg, Barberton, S.A., and London, consulting mining engineers, sole agents in South Africa for Messrs. Fraser and Chalmers, Chicago, and the Sprague Electric Railway and Motor Company, New York, has been dissolved by mutual consent. In future the business will be carried on by Edward Deaçon Chester, under the name of Edward Chester.

Magnetic Spectacles. — At the Leeds West Riding Sessions, on Monday week, John Conway, 26, optician, was indicted for having conspired with another man unknown, and obtained by false pretence £2 5s. from Sarah Battye, with intent to defraud, on the 16th November, at Huddersfield. The prisoner, who had been attending markets and fairs, went with another man to the house of the prosecutrix, pretended that he was a doctor, and represented that she was bad of sight and would be blind in six months, but that a pair of spectacles produced possessed a sufficient quantity of magnetism to cure her eyes. It was argued that in consequence of that representation she was induced to pay £2 5s. for the spectacles, which were worth only 2s. Prisoner was found guilty, and sentenced to six months' imprisonment.

A Christmas Treat.—The directors of the Metropolitan Electric Supply Company gave a Christmas treat the other day, at their own expense, to nearly 1,200 children collected from the unsavoury neighbourhood around the company's station in Sardinia Street, Lincoln's Inn Fields, the treat comprising a good tea, suitable entertainments to follow, and a distribution of comforters, crackers, and oranges to all the guests. I refer to this, says a writer in *Truth*, not for the glorification of the directors, who I am quite sure do not want that, but as a practical example to the many other well-to-do folk who, if they chose, might go and do likewise.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

General Electric Company, Limited.—An agreement of 22nd November (filed on the 25th November), between this company and Gustav Binswanger, of 71, Queen Victoria Street, manufacturer of electrical apparatus, is supplementary to an agreement dated 31st July, 1889, whereby the said Gustav Binswanger and J. H. Ward agreed to sell, and the company to purchase, for £40,381 6s. 8d., the property and premises mentioned therein, to be paid as to £15,381 6s. 8d. in cash, and the balance by the allotment of 1,000 fully paid second preference shares of £5 each and 4,000 fully paid ordinary of £5 each, the supplemental agreement provides for the allotment of the shares as follows: To Mr. Binswanger or his nominees, 1,000 fully paid second preference shares and 2,960 fully paid ordinary shares; to Mr. Ward or his nominees, 1,040 fully paid ordinary shares.

Fowler-Waring Cables, Limited. — The statutory return of this company made up to the 20th ult., was filed on the 1st instant. The nominal capital is £200,000 divided into 39,700 ordinary and 300 founders' shares of £5 each. 20,000 ordinary shares have been issued, upon which £3 per share has been called and paid. 291 founders' shares, credited as fully paid up, have also been issued.

Universal Automatic Advertiser Company, Limited (Mechanical, Electrical and General Engineers).—An agreement of 4th September, filed on the 21st October, provides for the purchase by this company from the London Battery Company, Limited, and Alfred Wm. Armstrong, of 132, Southwark Street, certain patent rights in connection with a machine for automatically changing advertisements without any attention (provisional protection No. 17,326 of 1888). The purchase consideration is £1,500 cash and 1,470 fully paid shares.

The statutory return of the company made up to the 24th ult. was filed on the 2nd inst. The nominal capital is £20,000 in £5 shares. 3,355 shares have been taken up, 1,470 being considered fully paid. Upon the remaining 1,885 shares, the sum of £3 per share has been called, the calls paid (including £20 paid in advance) amount to £3,475, and unpaid to £2,180. Registered office, 2, Prince's Mansions, Victoria Street, S.W.

Midland House-to-House Electricity Company, Limited.—The statutory return of this company, made up to the 11th ult., was filed on the 31st ult. The nominal capital is £100,000 divided into 19,900 ordinary and 100 founders' shares of £5. Only seven shares have been taken up and upon these no call has been made.

Liverpool House-to-House Electricity Company, Limited.—The statutory return of this company, made up to the 11th ult., was filed on the 12th ult. The nominal capital is £100,000 divided into 19,900 ordinary and 100 founders' shares of £5 each. Only seven shares are at present taken up, and no call has yet been made thereon. Registered office, 3, Cook Street, Liverpool, J. H. T. Turner, Secretary.

Lancashire and Cheshire House-to-House Electricity Company, Limited.—The statutory return of this company, made up to the 11th ult., was filed on the 12th ult. The nominal capital is £100,000 divided into 19,900 ordinary and 100 founders' shares of £5 each. Seven shares are taken up, but no call has yet been made thereon. Registered office, 3, Cook Street, Liverpool, J. H. T. Turner, Secretary.

Birmingham House-to-House Electricity Company, Limited.—The statutory return of this company, made up to the 11th December, was filed on the 31st ult. The nominal capital is £100,000 divided into 19,900 ordinary shares and 100 founders' shares of £5 each. Only seven shares have been taken up, but no call has yet been made thereon.

Cadogan Electric Light Company, Limited.—The annual return of this company, made up to the 30th ult., was filed on the 31st ult. The nominal capital is £30,000 divided into 3,000 preference and 3,000 ordinary shares of £10 each. The shares taken up are 1,194 preference and 765 ordinary, and the full amount has been called upon both classes of shares. The calls paid amount to £9,772 10s., and unpaid to £22 10s. Accompanying the return is a note stating that the nominal capital is given as £30,000 instead of £45,000, as the directors are advised that the special resolutions passed and confirmed on the 1st and 16th September, 1867, did not create new capital, but simply authorised the issue of 3,000 fully paid B shares of £5 each, out of the unallotted shares in hand.

NEW COMPANY REGISTERED.

Commercial Contract Corporation, Limited.—Capital £3,000 in £1 shares. Objects: To construct, contract for, establish, carry on, or to finance or provide capital for, electric lighting for public and private purposes, and for the production, transmission, storage, and use, by any means, of light, heat, electric, magnetic or other force. An agreement of 23rd December, between Otto Friederici of the first part, A. H. I. Daniell of the second part, and J. W. Gaze of the third part, will be adopted. Signatories (with one share each): Otto Friederici, Oncot, Muswell Hill; A. H. I. Daniell, 49, Moorgate Street; W. Cooper, 33, Hanley Road; L. W. Mercier and J. G. Burslem, 76, Finsbury Pavement; J. W. Gaze, Oak Hall, East Ham; W. B. Nicholson, 21, Claremont Square, N. Registered 3rd inst., without articles of association, by Waterlow and Sons, Limited. Registered office, 76, Finsbury Pavement, E.C.

CITY NOTES, REPORTS, MEETINGS, &c.

The Direct United States Cable Company, Limited.

The report of the directors for the six months ending December 31st, 1889, states that the revenue for the half-year (still subject to revision), after deducting out-payments, amounted to £42,356 12s. 1d., against £34,188 (after similar deductions) for the corresponding period of 1888, being a difference of £8,168 12s. 1d. in favour of the half-year under review, owing to the operation of the 1s. tariff throughout the whole of this period, as compared with tariffs of 6d. for two months and 1s. for four months in the corresponding period of the previous year.

The working and other expenses for the same period, including income tax, but exclusive of cost of repairs of cable, amounted to £15,509 5s. 8d. leaving a balance of £26,847 6s. 5d. as the net profit of the half-year, making with £2,719 2s. 11d. brought forward from the previous half-year a total of £29,566 9s. 4d. For the corresponding half-year of 1888 the working expenses and other payments amounted to £16,475 6s. 9d.

Interim dividends of 3s. 6d. per share for the quarter ended 30th September, 1889 (paid 24th October, 1889), and of 3s. 6d. per share for the quarter ended 31st December, 1889 (payable 24th January, 1890), together amounting to £21,248 10s., have been declared, and the balance of £8,317 19s. 4d. on the revenue account has been carried forward.

An interruption of the main cable occurred on the 9th October last, in the neighbourhood of the Green Bank, and was repaired on the 2nd November. The cable was found to have been broken by a vessel's anchor. On the 9th November, in a position near the previous break, the cable was again interrupted for the removal of a fault which interferred with efficient working. The fault was successfully cut out, and communication restored, on the 12th November. The cost of these repairing operations, including spare cable used, amounting to £4,119 14s., has been charged to the reserve fund account, as usual.

In the matter of the action of the Anglo-American Telegraph Company *v.* Cie. Française du Télégraphe de Paris à New York, the appeal to the Council of State mentioned in the last report is still pending.

United River Plate Company, Limited.

An extraordinary general meeting of this company was held at Winchester House yesterday, for the purpose of passing resolutions to the effect that debenture stock, providing for the payment of monies not exceeding £200,000 be issued, and for the purpose of redeeming the existing debentures by exchanging them for any of the new debentures, or as the directors might think fit. Lord Thurlow, who occupied the chair, said, he was very glad to meet a few of the shareholders. He did not expect a great attendance, owing to the number of proxies which they had received agreeing entirely with the course they proposed to take. He desired to take this opportunity of explaining to some extent the position the Company held at the present. The precise object of the meeting, however, was clearly stated in the notice, which had been read by the secretary, which object was to authorise a financial operation of two-fold significance. In the first place, to increase the working capital for extended operations, which course was perfectly justified by the extensions they were making in several directions; and, secondly, to take that opportunity of reducing the rate of interest they paid for debentures. He thought shareholders would agree that 7 per cent. interest was too large, especially when it was found money could be secured at less rates. They would be enabled, by paying £500 a year more, to borrow a further £50,000 a year in excess of the present debentures. He then showed that there had been a great increase in the number of subscribers, and that business was in a very forward state. It was a good proof of their prospects when he could come before them with the propositions submitted at the time when the Bank rate was 6 cent. and money could not be borrowed in London under 7 per cent.; also that gold at Buenos Ayres was 135 above par. These circumstances would no doubt satisfy the most critical shareholders. The intended trunk line between Buenos Ayres and Rosario would be made with the utmost economy, and made under most favourable circumstances. They were going to follow the existing line of railway between those places, the railway company having met them in a most friendly spirit, and they had assurance of that spirit continuing. With regard to other expenditure, as the system was growing, they were obliged to connect further houses, which, of course, took a considerable amount of money. The purpose of issuing additional capital was on account mainly of the trunk line. The resolutions would place the power in the hands of the board of exercising their discretion with regard to the debentures, subject, of course, to the criticism of the shareholders in general meetings. There was one other matter he wished to refer to, and that was the extraordinary high rate of gold in Buenos Ayres, which had, in fact, halved their dividend. It was a circumstance over which they had absolutely no control. He looked upon the company paying future dividends of 5 to 7 per cent. in bad years, and from 10 to 12 per cent. in good years.

The resolutions were then put separately to the meeting, and carried unanimously.

A vote of thanks to the chairman brought the proceedings to a close.

New Shanghai Electric Company, Limited.

At the second ordinary general meeting of the company held at its offices 41, Chapoo Road, Shanghai, on Tuesday, November 26th last. Mr. R. M. Campbell presided, and the following report was laid before the meeting.

The directors have the pleasure of submitting to the shareholders the audited accounts for the 12 months ended October 31st, 1889. After providing for all expenses, including the sum of Tls. 531.07 on account of extra wages account, the working account shows a profit of Tls. 4,050.86, which it is proposed to deal with as follows :—

	Tls.	c.
Plant account, for depreciation	780	77
Preliminary expenses	983	11
Dividend to shareholders for year ended October 31st, 1889, at 7 per cent.	2,100	00
Carrying forward	186	98
	Tls.4,050	86c.

It will be seen from the foregoing figures that in this, the first year of the company's working, *an extraordinary* expenditure amounting to Tls.1,514 18c. (on account of preliminary expenses and extra wages) say 5 per cent. on the capital of the company, has been *paid* out of earnings, which have also had to bear a considerably increased expenditure over the amount estimated, on account of the rise in the price of coals.

Working account for the 12 months ended October 31st, 1889.—To charges account, Tls.610 07c.; to coal account, Tls.3,115 18c.; to stores account, Tls.2,368 77c.; to fees account, insurance, wages, &c., Tls.6,703 08c.; to extra wages account, expenses on account new staff, Tls.531 07c.; to balance of profit 12 months' working, Tls.4,050 86c. Total, Tls.17,379 03c. By light account, Tls.17,199 49c.; by interest account, Tls.170 98c.; by bills in course of collection less bills outstanding, Tls.8 56c.; Total, Tls.17,379 03c.

Balance sheet on October 31st, 1889.—Liabilities :—To capital 300 shares at Taels 100, Tls.30,000; to profit and loss account, Tls.3,067 75c. Total, Tls.33,067 75c. Assets :—By cash in the Agra Bank and with secretary, Tls. 4,349 50c.; by plant, Tls.27,780 77c.; by furniture, stock, interest, &c., Tls.937 48c. Total, Tls.33,067 75c.

The Chairman said that, owing to the rise in the price of coal they had incurred a rather serious expense above what they had estimated for. As regards the extra wages account, they had, unfortunately, been obliged to dispense with the services of the old staff and to send home for a new superintendent. That expenditure, however, had been very well justified. Tls. ·179200 was not quite so much as they had expected from the lighting. They had been rather unfortunate with some of their private constituents, but they had been able to conclude a contract with the council for 12 more lamps on the Segreave road; and whereas when they began they were supplying 60 lamps at the average cost of Tls. 250 per lamp per annum, they were now supplying 72 at the average cost of Tls. 225. He was sensible of many shortcomings in the lighting. They had to depend upon a class of Chinese who were not very careful. The lamp trimmers were a source of endless bother. The directors had had the following objects in view, viz., the improvement and the extension of the light and the reduction of the price. They proposed to write off only a small sum for depreciation, and to pay a dividend of Tls. 7 per share to the shareholders. In doing so the directors believed they were performing a real duty to the company and to those who had come forward at a very critical time and saved its life.

A motion that a dividend of Tls. 7 per share be paid to each shareholder having been put and carried, the appointment of Messrs. J. Beattie and J. Prentice as directors was confirmed, and Mr. Campbell was reappointed a director.

The Chairman, at the conclusion of the meeting, said that in June last, when they were looking about and endeavouring to increase their working, the directors came to the conclusion that they must go in for incandescent lighting. They estimated that they could supply the Shanghai Club at a certain price, and he hoped by the end of June they would see the incandescent light there. Some delay in getting out machinery had been caused by the London strike, but he hoped it would all be out in time. When they gave the order for it they had to make sure that they had the money to pay for it. That had not been an easy matter, because at that time the company was not so high in public estimation; so with the sanction of his co-directors he had personally gone round and obtained the required capital from some 50 non-shareholders. That meant that the whole of that capital had been subscribed by persons who were as yet entirely outside the company, a very advantageous state of things, he thought. If the club lighting turned out the success their superintendent anticipated, they would be able to extend their operations. Orders for eight or ten installations had been promised in that event. That meant that they would be able to send home for more plant and start working as hard as they could. Once they got incandescent lights in the houses they would be able to make use of their power for other purposes besides lighting.

Mr. John Macdonald moved a vote of thanks to the directors, and particularly to Mr. Campbell, for the great ability they had displayed. They had taken upon themselves at a crisis in the company's history the burden of seeing that the use of the light did not die out. The ratepayers had on more than one occasion unmistakably shown that they did not want it to die out. As it was better than it had been in the past, he was sure it would be better in the future.

Schanschieff Electric Battery Syndicate.—An extraordinary general meeting of this syndicate was held yesterday at the offices, 44, Basinghall Street, E.C., for the purpose of considering a resolution for the voluntary winding up of the company and the appointment of liquidators. Representatives of the press were refused admission.

TRAFFIC RECEIPTS.

The Brazilian Submarine Telegraph Company, Limited. The traffic receipts for the week ended December 27th, amounted to £5,027; and for January 3rd, 1890, to £4,974.

The Cuba Submarine Telegraph Company, Limited. The estimated traffic receipts for the month of December were £3,000 as compared with £3,508 in the corresponding month of last year. The receipts for the month of September, estimated at £2,400, realised £2,372.

The Direct Spanish Telegraph Company, Limited. The estimated receipts for the month of December were £2,187, against £1,908 in the corresponding period of last year.

The Great Northern Telegraph Company, Limited. The receipts in December, 1889, £22,400; January 1st to December 31st, 1889, £274,800; corresponding months 1888, £272,200; and of 1887, £264,480.

The West Coast of America Telegraph Company, Limited. The gross earnings for the month of December, 1889, were £6,315.

The Western and Brazilian Telegraph Company, Limited. The traffic receipts for the week ending December 27th, 1889, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £3,683; for January 3rd, 1890, £[illegible],682.

West India and Panama Telegraph Company, Limited. The estimated traffic receipts for the half month ended the 31st December are £2,643, as compared with £2,392 in the corresponding period of 1888. The September receipts, estimated at £4,240, realised £4,256.

ELECTRIC LIGHT REGULATIONS AND CONDITIONS.

ELECTRIC LIGHTING ACTS, 1882 AND 1888.

FOR the purpose of the provisional orders of the Board of Trade granted by that department, it is now preparing regulations for securing the safety of the public and for ensuring a proper and efficient supply of energy, which will, when supplemented by further special regulations in certain cases, be applicable to all systems of supply.

The following is a copy of the draft regulations in their present form; but before issuing the regulations, the Board of Trade proposes to refer the draft to various authorities and bodies interested, for their observations and suggestions, and that it must, therefore, be understood that the regulations are at present merely in a draft form and must not be taken as representing the final opinion of the Board of Trade. They are made subject to the power of the Board of Trade, to make such further and other regulations as they may think expedient for the purposes above-mentioned. Perhaps some of our readers may desire to criticise or comment upon them.

Definitions.

In these regulations the words, terms, and expressions to which by the   , order, 18   , meanings are assigned, shall have the same respective meanings, provided that in these regulations—

The expression "the order" shall mean the
                    , order, 18   .

The expression "the undertakers" shall mean the undertakers for the purpose of the order.

The expression "consumers' wires" shall mean any electric conductors on a consumer's premises, which are connected with the service lines of the undertakers at the terminals at which energy is delivered to such consumer.

The expressions "low pressure supply," "high pressure supply," and "extra high pressure supply," are used in these regulations with reference to the difference of electrical potential between the two conductors through which the supply of energy is given, or between any part of either conductor and the earth; a difference of potential on any alternating current system being taken to be the equivalent of a difference of potential on a continuous current system, when it produces an equal heating effect if applied to the ends of a thin stretched wire or carbon filament; that is to say :—

(*a*) Where the conditions of supply are such that the difference of potential, as above described, cannot at any time exceed 300 volts, if the supply be on a continuous current system, or the equivalent of 150 volts if the supply be on any alternating current system, the supply shall be deemed a low pressure supply.

(*b*) Where the conditions of supply are such that the difference of potential, as above described, may exceed the limits of a low pressure supply but cannot exceed 3,000 volts, or the equivalent of 3,000 volts on either system, the supply shall be deemed a high pressure supply.

(*c*) Where the conditions of the supply are such that the difference of potential, as above described, may on either system exceed 3,000 volts or the equivalent of 3,000 volts, the supply shall be deemed an extra high pressure supply.

Mains, service lines, and other conductors and apparatus are referred to as low pressure, high pressure, and extra high pressure mains, &c., according to the conditions of the supply delivered through the same or particular portions thereof.

I.—REGULATIONS AS TO SAFETY.

General.

1. Save as hereinafter provided, the supply of energy delivered to the terminals on the consumer's premises shall be low pressure supply.

2. A high pressure supply shall not be delivered to the terminals on any consumer's premises except for special purposes, and with the approval of the Board of Trade, on the joint application of the consumer and the undertakers, and subject to such further regulations as the Board of Trade may from time to time prescribe.

3. An extra high pressure supply shall not be given except to distributing stations or other premises in the sole occupation of the undertakers, and with the written consent of the Board of Trade, and subject to such conditions as the board may prescribe.

3A. The undertakers shall provide and fix, to the satisfaction of the local authority, such appliances or apparatus as the Board of Trade may from time to time consider advisable, whether for safety or for the prevention of the limits of difference of potential above stated, or such other limits as may from time to time be fixed by the Board of Trade in place thereof, either generally or in particular cases, from being exceeded; and sealed patterns of any such appliances or apparatus shall be deposited at the office of the local authority.

Mains and other Conductors.

4. The maximum working current in any conductor used in connection with the supply of energy shall not be sufficient to raise the temperature of the conductor in any part to such an extent as to materially alter the physical condition or specific resistance of the insulating covering, if any, or in any case to raise such temperature to a greater extent than 30° of Fahrenheit's thermometer, and efficient automatic means shall be provided, which shall render it impossible for this maximum working current to be by any accident exceeded to the extent of 25 per centum, even for short intervals of time; and special care shall be taken that the cross-sectional area and conductivity at joints are sufficient to avoid local heating, and that the joints are protected against corrosion.

5. Conductors used for a high pressure supply shall be either separately or collectively completely enclosed in wooden pipes or casing, not less than one-quarter of an inch in thickness, placed in efficient connection with the earth, either throughout their length, or at points not separated from each other by more than 100 yards. Provided that where the conductors pass through any junction or draw box, which is not also used for low pressure conductors, the portions so passing through such junction or draw box need not be so closed.

6. Every conductor used for a high pressure supply must be continuously insulated with a durable and efficient material, to be approved by the Board of Trade; and the insulation resistance of any high pressure conductor, including joints, shall not be permitted to fall below fifty megohms per mile. This insulation must be further efficiently protected on the outside against injury or removal by abrasion. Provided that when one of the two conductors forming the line and return for any circuit or part of a circuit completely encloses the other conductor, the outer conductor, if efficiently connected to earth at the source of supply, need not be continuously insulated except to such extent as may be necessary to avoid disturbance to other lines or works.

7. Except where concentric conductors are used as provided in the preceding regulation, the insulation resistance of any complete circuit used for high pressure supply, including all devices for producing, consuming, or measuring energy, connected to such circuit, shall be such that should any part of the circuit be put to earth, the leakage current shall not exceed $\frac{1}{25}$th of an ampère in the case of continuous currents, or $\frac{1}{50}$th of an ampère in the case of alternating currents. Every such circuit used for high pressure supply shall be fitted with an indicating device, which shall continuously indicate if the insulation resistance of either conductor fall below the conditions required by this regulation.

8. In the case of a high pressure supply on any alternating current system, where separately insulated conductors are used, precautions shall be taken against the discharge of electric sparks between the insulating covering of oppositely charged conductors, by providing a sufficient connection of a conducting nature between these coverings throughout.

9. Where any portions of any conductors belonging to the undertakers are exposed in such a position as to be liable to be struck by lightning they shall be sufficiently protected by appliances of such pattern and construction as may from time to time be prescribed or approved by the Board of Trade.

Conduits.

10. All conduits used as receptacles for conductors shall be formed of durable material, and of ample strength to resist any reasonable pressure due to heavy traffic, or other forces to which they may be subjected.

11. Where the conductors in any circuit are not sufficiently insulated, the conduit must be efficiently drained, so that no accumulation of water can take place in any part sufficient to raise the level of the water into contact with the conductors.

12. All conduits for conductors laid in streets, in which gas mains are also laid, must be thoroughly ventilated, or otherwise efficiently protected against an accumulation of gas.

13. All street boxes, manholes, junction and draw boxes must be efficiently drained and ventilated, and their covers so secured that they cannot be opened except by means of a special appliance.

Distributing Stations.

14. Distributing stations to which a high pressure supply is given from generating stations, and from which a low pressure supply is given to consumers, must be established on suitable premises in the sole occupation of the undertakers; and the supply from such stations must be constantly controlled by a skilled person in the service of the undertakers, and printed directions must be conspicuously exhibited in every station, providing for the action to be taken by such person in charge in any emergency, the occurrence of which may be reasonably considered possible; and these directions shall be submitted for the approval of the Board of Trade.

15. In every case where the supply is transformed at a distributing station, as described in the preceding regulation, means must be provided to the satisfaction of the Board of Trade, which shall render it impossible that the low pressure mains shall be at any time charged to a dangerous difference of potential to the earth, owing to any accidental contact with the high pressure system either within or outside the distributing station.

Consumer's premises.

16. Where the general supply of energy is a high pressure supply, and transforming apparatus is installed on the consumer's premises connected to the distributing mains by high pressure service lines, and to the terminals by low pressure service lines, the whole of the high pressure service lines, conductors, and apparatus, including the transforming apparatus itself, so far as they shall be on the consumer's premises, shall be completely enclosed in metal casing not less than one quarter of an inch in thickness, efficiently connected to earth, and every portion of such casing shall be securely fastened.

17. In any case where any transforming apparatus is installed on the consumer's premises, as described in the preceding regulation, means must be provided to the satisfaction of the Board of Trade, which shall render it impossible that the low pressure service lines and consumer's wires shall be at any time charged to a dangerous difference of potential from the earth, owing to any accidental contact with the high pressure system either within or outside the transformer.

18. All terminals, low pressure service lines, or other apparatus between the terminals, and the transforming apparatus, or other source of supply so far as they shall be on the consumer's premises, shall be completely enclosed in insulating cases or coated with insulating material in such a manner that no part of them can be touched by any person without the removal of such case or coating; and they shall be, wherever exposed, efficiently protected against injury to the insulation.

19. The energy shall be delivered to the consumer's premises in some manner free from the risk of causing fire on the premises in question, whether such fire should or might be originated during or in consequence of a proper or improper supply of energy or by reason of the cessation of any supply, or should or might be partly due to any defective action of the lamps, motors, storage cells, conducting wires, transformers, or other fittings connected with the terminals for the purpose of using the supply of energy.

20. If the undertakers are reasonably satisfied, after making all proper examination, by testing or otherwise, that a connection with the earth exists at some part of a circuit of such resistance as to be a source of danger, and that such connection does not exist at any part of the circuit belonging to the undertakers, then and in such case any officer appointed by the undertakers, and duly authorised by them in writing, may, for the purpose of discovering whether such connection with the earth exists at any part of a circuit within or upon any consumer's premises, at all reasonable times, after giving one hour's notice of his intention to do so, enter any such premises and disconnect the consumer's wires from the terminals of the service lines, and may require the consumer to permit him to inspect and test the wires and fittings belonging to the consumer and forming part of the circuit.

21. If on such testing the officer discovers that a connection exists between the consumer's wires and the earth, and that such connection has an electrical resistance not exceeding 5,000 ohms, or if the consumer does not give all due facilities for such inspection and testing, the undertakers shall forthwith discontinue the supply of energy to the premises in question, giving immediate notice of such discontinuance to the consumer, and shall not recommence such supply until they are reasonably satisfied that such connection with the earth has been removed.

22. If any consumer is dissatisfied with the action of the undertakers, either in discontinuing or not recommencing the supply of energy to his premises, the wires and fittings of such consumer may, on his application, be tested for the existence of connection with the earth by an electric inspector; or if no electric inspector has been appointed, by a person appointed by the Board of Trade. For the purposes of such testing, the provisions of the order as to the testing of service lines shall, with the necessary modifications, apply to the testing by such inspector or person of the consumer's wires and fittings under these regulations.

Penalties.

23. If the undertakers make default in complying with any of the preceding regulations, they shall be liable to a penalty not exceeding £20 for every such default, and if they fail to discontinue the supply of energy to any consumer's premises upon discovery of connection with the earth, or if they recommence such supply

before being reasonably satisfied that no such connection, having such electrical resistance as aforesaid exists, they shall be liable to a further penalty, not exceeding £20, for every day during which such offence continues.

The imposition of any penalty under this regulation shall not affect the liability of the undertakers in respect of any damage or injury which may be caused by reason of such default.

II.—Regulations as to Supply.

1. One week, at least, before the undertakers are ready to commence to supply energy through any feeding, charging, or distributing main or mains, they shall serve a notice upon the local authority of their intention to commence such supply.

2. From and after the time when the undertakers commence to supply energy through any distributing mains, they shall maintain a supply of sufficient power for the use of all the consumers for the time being entitled to be supplied from such main, and such supply shall, except so far as may be otherwise agreed upon from time to time between the local authority and the undertakers, be constantly maintained at such pressure as may be fixed under the provisions of these regulations. Provided that, for the purposes of testing, the authority by whom the electric inspector is appointed, may give permission to the undertakers to discontinue the supply at such intervals of time and for such periods as it may think expedient, and that for any other purposes connected with the efficient working of the undertaking, the undertakers may, with the permission of the Board of Trade, discontinue the supply at such intervals of time and for such periods as the Board of Trade may think expedient. Where the supply is so discontinued, notice of such discontinuance, and of the probable duration thereof, shall in every case be forthwith served upon the local authority.

3. The system of distributing mains must be so arranged that in case it becomes necessary to stop the supply through any portion of a main for a longer period than one hour, owing to the execution of repairs, or for any other reason, the amount of supply so stopped shall in no case exceed a maximum power of 100,000 watts; and in no such case shall it be necessary to cut off the supply to more than 40 houses or tenements.

4. During the whole of a period when a supply of energy is required to be maintained by the undertakers in the distributing mains, under the order and these regulations, it shall be given at a constant pressure (in these regulations termed "the standard pressure") to be fixed as hereinafter specified. Provided that the undertakers shall be deemed to have complied with the requirements of this regulation, so long as the pressure does not at any point vary more than 3 per cent. from the corresponding standard pressure in the case of a general supply at low pressure, or 2 per cent. in the case of a general supply at high pressure, unless changes in pressure recur so frequently as to cause unsteadiness in the supply.

5. The standard pressure may be different for different points of any pair of distributing mains, but it shall not be such as to cause a difference of potential after transformation of energy if required at any pair of terminals on the consumer's premises of more than 115 volts, or the equivalent of 115 volts, or less than 45 volts, or the equivalent thereof. And in distribution, on the three-wire system, the central main shall be considered to form a pair with either of the outside mains, and similarly for multiple wire systems.

6. In the case of transformation of energy on the consumer's premises, the undertakers shall give the consumer the choice of a supply at either of two different pressures, one of which shall be approximately half the other.

7. The standard pressure shall be fixed by the undertakers for every pair of distributing mains, and notice of such amount of such standard pressure shall be given to the local authority before the undertakers commence to supply energy to consumers through such mains, and shall not be altered except by permission of the local authority, and upon such terms and conditions as the local authority may impose, and after public notice has been given during a period of one month, in such manner as the local authority may require, of the intention of the undertakers to apply for permission to alter the same. Provided that the undertakers may appeal against any decision of the local authority, under this regulation of the Board of Trade, whose decision shall be final.

8. The supply of energy upon any premises shall (except by agreement) be given by one or more pairs of terminals situated thereon, the respective terminals of each pair being situated at a safe and convenient distance from one another, and being in connection, respectively, with the positive and negative mains; and the undertakers shall be responsible for the maintenance of such terminals, and any other lines, fittings, and apparatus belonging to the undertakers, or under their control, upon such premises in a fit and proper condition for supplying energy.

9. The variation of pressure at the supply terminals on any consumer's premises shall not, under any conditions of supply, which the consumer is entitled to receive, nor at any time, exceed four per centum from the mean pressure, whether such variation be due to the resistance of the service lines or apparatus belonging to the undertakers, or to any action or effect produced by such apparatus, for which the consumer cannot be shown to be responsible, or, partly to any variation of pressure in the distributing mains from which the supply is taken.

10. If the undertakers make default in complying with any of these regulations as to supply, they shall be liable to a penalty not exceeding £5 for every such default.

REVIEWS.

Absolute Measurements in Electricity and Magnetism. By ANDREW GRAY. Second edition, revised and greatly enlarged. London: Macmillan & Co.

There are very few, if any, who, acquainted with the first edition of Mr. Gray's work, will not have greatly appreciated its value, and welcome the new and enlarged form in which it now appears. The additions which have been made comprise, amongst others, a fuller account of the determination of H, a description of Sir William Thomson's standard electrical instruments, a more complete treatment of the graduation of instruments, especially by electrolysis, an extension of the theory of alternating current machines, additional information regarding the measurement of activity in the circuits of alternators, and an improved chapter on the theory of dimensions of physical quantities. The necessity at the present day for precise measurements makes the description of standard instruments particularly valuable, whilst the fuller dealing with the theory of alternators will be much appreciated, though in many cases the author hardly sufficiently completes his work, the result being that a good deal of time is wasted when the book is used for reference purposes purely. As an instance of what we mean we would take page 279, which deals with measurements by the electrometer; an equation (19) is here given, viz.:—

$$D = 2\,\frac{k}{2}(V_1 - V_2)^2,$$

which represents the relation between potential difference and the deflection corresponding to this on a Thomson electrometer. Now the quantity in which one is interested is the value of $(V_1 - V_2)$, not the value of D, as the equation would indicate, and, moreover, to determine $V_1 - V_2$, we require to know the value of k; it is true we are told in another part of the book, in a somewhat indefinite way, how k can be determined, but this is not satisfactory, and there seems no reason whatever why the author should not have combined the equations in a practical form, so that one could see almost at a glance what is practically required. This want of definiteness will be found in many places in the book, and it is unfortunately very often a marked characteristic of the theoretical professor.

Potential and its Application to the Explanation of Electrical Phenomena Popularly Treated. By Dr. TUMLIRZ, Lecturer in the German University at Prague. Translated by D. Robertson, M.A., LL.B., B.Sc., formerly one of the assistant masters, University College School. Rivingtons, Waterloo Place, London.

In this work the subject of potential is treated from the physical side, the use of technical mathematics, it being stated, being all but avoided. (This latter statement is, we think, decidedly overdrawn, though, in a certain sense, it is correct.) The translator remarks, in his preface, that "there does not appear to be any elementary systematic treatise on the subject in the English language;" we believe that this is so, but it may be questioned whether there is any great need of a work of the kind; if, however, we admit that such a book is required, the present one admirably fulfils its object.

The book is divided into four chapters: the first treats of the potential of gravity; the second and third, of electric potential in its application to statical electricity and galvanic currents; and the fourth, of magnetic, electro-magnetic, and electro-dynamic potential.

A Guide for the Electric Testing of Telegraph Cables. By Col. V. HOSKIŒR, Royal Danish Engineers. E. and F. N. Spon, London.

This little book has for many years proved a valuable guide for young men who have to learn practical testing. The diagrams are clear, and the several tables at the end of the book very useful; and, as the new edition has been thoroughly revised, and some few new methods added, we feel sure that it will meet with the same success as the two former editions.

Kalender für Elektrotechniker. By F. UPPENBORN. Munich: R. Oldenburg.

This useful pocket-book and diary has reached its seventh annual edition. It is well known to most electrical engineers who are able to read German, and on the Continent it is probably as well known and appreciated as the "Munro and Jamieson" is in England. It contains, besides numerous tables and formulas, contained in 284 well printed and illustrated pages, a diary, and about 60 pages of advertisements; the latter will hardly be appreciated by those who care to carry the pocket-book in their pockets. In a separate binding there is a directory of electricians, with their addresses, to the number of 946, residing in various parts of the world. This might be useful to some were more care exercised in its compilation, for we note many addresses which have been changed at least two years ago.

Die Fortschritte der Elektrotechnik. By Dr. CARL STRECKER. Berlin: J. Springer.

Has reached its second year of publication, bringing the subject up to the end of 1888. Considering the very rapid progress of electrical engineering it may be thought somewhat out of date, and the publisher, Mr. Julius Springer, of Berlin, wrote us a letter in a somewhat apologetic tone, mentioning that the next issue will appear in April next, bringing the matter up to the last day of 1889. We cannot but admire the energy and care which has been devoted to this book, every article of note, every book that has been published, and every paper or lecture which has appeared in any newspaper or periodical in any language receives some mention, with abstracts of the most important matters, and short descriptions of many new inventions. The index, which gives in alphabetical order the subject matters and names, is well arranged, and the volumes already published ought to be appreciated by all who wish to refresh their memories about things electrical which have happened within the period of this excellent encyclopædia.

STRANGE, BUT TRUE.

AN alarming case occurred last week at a cotton mill in the country, owing to an escape of gas. The circumstances are of such a nature as to deserve a passing notice. It appears that at breakfast time on Saturday morning, the gas was turned off at the meter, but the jets throughout the mill were left open, *as is customary*. During the afternoon of the same day some repairs were being effected in the cellar, and it was found necessary to turn on the gas, but the jets in the various spinning rooms were neither closed nor lighted, so that the gas was escaping unchecked for several hours. The operatives went to the mill, as usual, at six o'clock on Monday morning, and on entering the spinning rooms they found that the atmosphere was strongly impregnated with gas. The rooms were lighted up, but happily, we are informed no serious results as regards explosions ensued from this somewhat hazardous proceeding. The machinery had not been in motion above ten minutes when the effects of the gas were quickly observed. The minders in the four top rooms began to complain of sickness, whilst others were completely overcome and fell down unconscious. Over twenty of them had to be carried into the mill yard, and the condition of some was so serious that with medical aid artificial means of respiration had to be resorted to before several of the unconscious persons recovered. On the alarm spreading, the workpeople left the mill. The windows of the mill were subsequently opened and the gas turned off, so that in a few hours the place was thoroughly ventilated. The remarkable fact was, that the ventilation was not immediately effected when the gas was lighted by means of an explosion. This circumstance was extremely providential, but it is to be hoped that for the future the custom of leaving the jets open will not be adhered to. It is, however, very strange that repairs should have been carried out in ignorance of the prevailing custom.

ENGINES FOR LARGE INSTALLATIONS.

MESSRS. ROBEY & CO., of Lincoln, have for some years past been perfecting the details of an engine which they describe as the improved coupled compound (Class E) horizontal fixed engine, with patent automatic trip expansion gear. An engine of this type was conspicuous in the electric lighting department of the recent Glasgow Exhibition, and proved itself to be exceptionally suitable for large permanent electric light installations. When a large number of machines are driven by one engine it is highly important, not only that great strength and solidity should be secured, but also that perfect regularity in running should be maintained with frequently varying loads.

The frame of the engine is of the most solid and substantial character, and is a great improvement upon the original type of girder engine as first introduced into this country, the metal being disposed so as to resist the direct line of the strains. The framing is absolutely rigid in all directions, and has a most substantial base both under the main bearing and the cylinder. The bearings are of very large size, made of the best material, and fitted with superior lubricators for continuous running.

The special feature of the engine is the arrangement of the automatic valve gear, which has been produced after a long series of experiments with the principal valve gears hitherto in use. The steam is admitted by two Cornish equilibrium valves, one at each end of the cylinder. These are lifted alternately by a fixed eccentric, so as to give a constant lead, while the point of release, and therefore of cut-off, is decided by the governor. The latter is very delicate in its action, and, being relieved of all working strain, is so constructed as to give a wide range of cut-off, with very slight variation in speed.

The exhaust consists of a special arrangement of Corliss valve, which gives a quick, wide opening to the exhaust, with a very small travel. The exhaust valves are placed under the cylinder, which is thus kept constantly drained; and as all passages are short, waste of steam from this cause is avoided.

For electric light installations the valve gear can be controlled by the "Richardson-Nevile" electric regulator, which enables the engine to be controlled by the electric current itself, thus enabling either a constant current or constant E.M.F. to be maintained with very varying loads. The valve gear is also arranged so that the engine can be stopped by merely pulling a cord at any part of the mill or factory, a provision which is invaluable in case of accident to persons or machinery.

The engine is designed to work at from 80 to 100 lbs. pressure, and all the working parts are abundantly strong, and the wearing surfaces large. High pressure single engines are made of this type from 10 H.P. to 50 H.P. nominal; coupled engines and compound engines from 20 to 100 H.P. The engine will give out the best duty when developing about 2½ times its nominal power, but is strong enough to work up to four times that amount.

ON THE RESPECTIVE MERITS OF CONTINUOUS AND ALTERNATING CURRENTS.

(*Continued from page* 640.)

WE have been speaking of the disadvantages of factories working with continuous currents, viz.:—

1. The necessity for the central station to be in the centre of the region supplied.

2. The zone of distribution is limited. To these we must add:—

3. The system is too costly for sparsely-populated districts; this is admitted even by the advocates of the system.

4. The arc lamps fed by these currents must be set in a series of twos, or the energy of one in every two must be taken up by a resistance. This is not denied by any advocate of the continuous current, but is not considered sufficiently important to nullify the striking attributes of the system.

The author now turns to the second system of electric distribution of energy, viz., the system of alternating currents and transformers.

He criticises the advantages claimed for this system; it admits of the use of slender conductors, and, consequently, of the central stations being established outside of the circle of lighting; moreover, the electricity can be distributed in sparsely-populated districts.

The radius of distribution is not so strictly limited, since the net cost of the conductors is less.

It facilitates the cheaper use of natural forces, even at a distance from the quarters to be lighted.

If desirable, we can make use of incandescent lamps with only 50 volts tension. We can also employ arc lamps fed by alternating currents without loss of energy, and the tension need not be so great as when continuous current lamps are employed.

The regulation of the tension on the entire system is simplified; it is effected without loss, and is more reliable than when continuous currents are employed.

As regards the demerits of the system:

It necessitates the use of high tension in the principal conductor.

Alternating current dynamos give a smaller yield than continuous current ones.

It is not so easy to couple the machines upon one exterior circuit.

The transformation of the energy in the transformers involves considerable loss, and increases the uncertainty and the dangers of the working.

Alternating currents wear out the incandescent lamps more rapidly than continuous currents.

The arc lamps with this system have less of effective power, and in many establishments their noisiness would be an obstacle to their use.

A really practical motor in connection with this system is as yet unknown.

It is not possible to accumulate the electrical energy produced by alternating currents machines.

The alternating current is less easily measured.

The incessant reversal of the current's direction is fatal to insulation, and is a bar to the complete utilisation of the section of the copper wires.

The opponents of the system dispute the reality of the advantages claimed for it.

It is a fact generally recognised that the alternating current makes the use of light wires feasible, especially in the case of overhead conductors.

But as against these advantages it is necessary, in the case of subterranean conductors, to take the following into consideration: the price of the copper is but a small part of the cost; the insulation of the cables has to be performed with very great care, and is therefore expensive; the cost of the sheathing and of the cable laying does not alter in proportion to the diameter of the wires.

The alternating current permits of the central station being established outside of the circle of lighting; but it remains to be seen whether this is really practicable, and whether the advantages inherent in distance are counterbalanced by the increase in the price of the conductor, and the decrease in the uncertainty in the working.

The author's calculations, with reference to the Schwartzkopff project for the town of Halle, indicate that, even under very favourable conditions, the advantages of alternating currents are not very considerable.

Then we must take into consideration that it means the employment of not merely one, but several cables.

It is otherwise, he adds, where natural forces, waterfalls for instance, can be made use of, as then it is much more advantageous to employ alternating currents.

In such cases overhead conductors may be used; but obviously this can only be for portions which are altogether outside the town, and this means a considerable increase in the extent of a rational service.

By means of alternating currents electricity may be distributed in sparsely populated quarters; no one disputes this.

The area of distribution is not so strictly limited, because the net cost of the conductors is less. The author has already noted this.

He quotes Mr. Miller as follows:—"The economy in copper effected by the use of high tension currents is only of importance for considerable distances. It is only in an area of 2,000 metres that the conductor of a transformer system is found less costly than the five-conductors system—that is, providing both are within the area to be lighted."

The alternating current system permits of the cheap utilisation of natural forces, even at a distance from the area to be lighted.

As regards this the author merely remarks that it is necessary to exclude those cases in which, upon a calculation of the pecuniary results of the enterprise, it is shown that the profit on the excess of the price of the conductor is greater than the economy realised upon the coal.

It is possible, when desired, to make use of incandescent lamps with only 50 volts tension. Low tension incandescent lamps with a thick carbon filament give an excellent light, and the filaments are not easily broken. When the current is continuous they can only be used in series of twos, or with a resistance to take up the current of every second lamp.

Arc lamps fed by alternating currents may be even burned singly without loss of energy; nor will they need so great a tension as the continuous current lamps.

As this has often been claimed as an advantage compensating for the many drawbacks of the system, we will pay it some attention. We need hardly say that a transformer of a special pattern is necessary in employing a different tension to that which is used with incandescent lamps.

The peculiar conditions of the working of an apparatus of this kind, nevertheless, involve considerable leakage, which will be proportionately great as the apparatus itself is small. The installation, therefore, of a transformer for a single arc lamp will not only be costly (the transformer and conductor being supplementary), but will also involve losses of sufficient importance to make it preferable to insert the lamp within the circuit of incandescent lamps, in combination with appropriate resistances. The installation of a transformer with a special conducting wire is only recommendable when the number of lamps is very large, in which case, even with continuous current lamps, the difficulties need not be very grave, since the necessity for placing two pilot lamps in series will no longer exist, as by placing two groups of lamps in a 3-conductors system, it will always be possible to make a uniform distribution of the lamps at work.

Whilst an arc lamp with the alternating current only demands a tension of 35 to 40 volts, an arc lamp with the continuous current requires about 50 volts. This increase of tension is made necessary by the counter-electromotive force which is generated in the hollow of the positive carbon of the continuous current lamp; the result being that a continuous current lamp of 10 ampères consumed nearly as much energy as an alternating current lamp of 12 ampères.

We shall presently mention a cause which more than compensates for this difference.

The regulator of the tension over the entire system is simplified; it is effected without loss, and it affords greater certainty than is obtainable by employing continuous currents.

This assertion the author quotes from the Frankfort Commission's report, and from a pamphlet published by the Société Helios, of Cologne. He adds that he intends at some future time to enter into a detailed examination of the difficulty of maintaining an equal tension with alternating current machines of the ordinary type, also of the question of their arrangement in parallel series, and also of the question of the wear and tear of incandescent lamps. He confines himself to stating that the majority of practical electricians is of a contrary opinion.

He then proceeds to discuss the alleged disadvantages of the alternating current system with transformers.

1. The alternating current necessitates the use of high tensions in the principal conductors. This fact, which has the great advantage of allowing the use of small section principal conductors, has also two drawbacks.

The tension being greater it is more difficult to insulate the conductors. The insulation of the cables on a system of alternating currents with high tension should, it is well known, be more thorough than is necessary in a system of continuous currents with low tension. The condition, enforced in every European city, of placing the cables underground, side by side with telephone and telegraph lines, necessitates further the employment of concentric cables for avoiding the disturbances occasioned by induction upon the latter. The price of the conducting cables is consequently raised to a point at which the advantages of slender copper conductors largely disappear, to vanish altogether when it becomes a question of long distances.

The necessity for perfect insulation has a considerable restrictive effect upon the tension that might be employed.

According to Spencer, who is said to have installed 400,000 lamps, a tension of 1,000 volts is the best to work with. The fact is, the majority of American central stations use this tension, and none go beyond 2,000.

Crompton asserts that even with 1,000 volts the insulation is still uncertain, and that in America difficulties are still met with when this tension is used. According to him the insulation must be affected by alternating currents at high tension; and he doubts if the insulation of the central station at Nancy, which works with 2,000 volts, will continue to be as efficient as hitherto.

It may also be presumed, as a matter of fact, that it is impossible to predetermine the duration of a cable for high tension.

On the other hand, the firm of Siemens and Halske has frequently supplied concentric cables for 2,000 volts, and these cables have so far done well.

The cables for the Ferranti undertaking, in London, are intended to bear a tension of 10,000 volts. It is an important venture, and one which many persons think bound to fail, though others consider its success assured. In any case the result will go a long way towards solving the question in dispute.

The high tension of alternating currents may occasion fatal accidents and fires. The American central stations have within the past year shown us in 94 instances that alternating currents with high tension can be fatal to human life. Likewise the experiments made by Brown show that in this respect alternating currents are more dangerous than continuous ones, and that even low tension currents may cause death, especially when the number of alternations is considerable. It must, however, be said that there is an enormous difference between American and European installations. The best thing to be done is to make contact very difficult, if not impossible, with the primary conductors.

Some companies place transformers with their customers. The Société Hélios is for supplying each customer with a transformer and meter combined; this would not be larger than a gas meter. Other firms propose to enclose the transformers in safety cases beneath the pavement (this was Zwartzkopff's project for Halle). For transformers in the interiors of houses complete insulation, and something in the nature of a fire safe would be necessary. In America, the insurance companies insist upon the transformers being placed outside of the buildings. An English society has, nevertheless, declared that it will not raise its premiums if the transformers used in the Ferranti business are carefully made and installed. In any case an extreme prudence will be necessary.

Another question is, whether there is not a great danger in the contact, which is often necessary, with secondary conductors. The enemies of the system of alternating currents have so strongly insisted upon this danger, as to make a close examination of the question necessary.

For such contact to be dangerous, a combination of three conditions is necessary.

1. The principal conductor must communicate with the earth.

2. The primary conductor must be connected with the secondary conductor.

3. There must be communication between the person and the earth.

The first of these conditions can hardly be qualified.

The third becomes realised if the person in question rests upon damp ground, or is in contact with pipes for either gas or water.

Absolute security will only be attained by making the second impossible. It will not be enough to apply cut-outs to the principal conductors, since it is possible and even likely that the communication does not consist in a short circuit without resistance, but in a luminous arc offering sufficient resistance to prevent the production of a current capable of melting the cut-out.

In such a case cut-outs in the secondary conductor would be of no use at all, as they are intended for a current of much greater strength (with low tension). The only real protection, then, consists in laying the insulating stratum between the primary and secondary conductors thickly enough to maintain insulation, at all events, and in carefully avoiding anything like heat or damp.

It is a choice between sacrificing something of the utility of transformers, and of abandoning the principle which consists in obtaining the maximum of action with the minimum expenditure of copper and iron.

In many cases, might it not be better to make use of a protecting box? It would always be feasible, and it would certainly avoid the danger to life and property.

It has, we are aware, been proposed to insert between the two conductors a conducting stratum in connection with the earth, or to connect the secondary conductor with the earth in a permanent manner; but these methods involve greater losses and sacrifices than the insertion of an insulating stratum.

(*To be concluded.*)

JOHNSON AND PHILLIPS.

THIS firm has been exceedingly busy in all departments for many months past. The principal increase has been in electric lighting work, and they are just completing Kapp alternating current plants for three central stations—for the Metropolitan Company, in London, another for Keswick, and a third for Hong Kong. The growth of orders for the "Brockie-Pell" arc lamp has been remarkable, and they are coming in from all parts of the world, thus showing the high estimation in which it is held. One of the largest installations in London for these lamps is for the General Post Office, where 76 are to be placed in the sorting rooms; another is for the lighting of the streets of Hong Kong; whilst several more large lots are being supplied to the trade in various parts of the world.

The patent liquid insulator has been in great demand during the year for overhead electric light wires, and large numbers have been shipped to all parts. Electric light engineers have availed themselves of this valuable insulator, and telephone companies have adopted it in one or two instances where unusual difficulties existed.

The outlook for 1890 is extremely encouraging.

THE TELEGRAPH MANUFACTURING COMPANY.

WE hear from Helsby that the last year has been an extremely busy one, especially the last six months, during which the output has been doubled. All departments have been fully occupied, especially the cable and gutta-percha wire-covering departments, and the firm has large orders for all classes of goods in hand for the ensuing year.

CALLENDER'S BITUMEN TELEGRAPH AND WATERPROOF COMPANY.

THE work of this firm during the past year has been very largely in connection with underground mains for electric lighting.

It has carried out several large contracts, undertaking the excavation and all the operations consequent thereon, the construction of the protecting conduit or case for the cables, and the manufacture and laying complete of the cables themselves, with all service and other boxes to form a complete distributing network.

The most important of these contracts are :—

Liverpool, where there has been laid a complete network throughout nearly the whole of the business quarter of the city, from which many thousands of lights are already being supplied. This work is for the Liverpool Electric Supply Company, Limited, and is by far the most extensive system in operation in England.

Whitehall.—For the Metropolitan Electric Supply Company, Limited, comprising mains from the Thames Embankment to Charing Cross Road and Pall Mall.

Strand.—For Messrs. A. and S. Gatti, complete system of distribution in the Strand and neighbouring streets from the station in Bull Inn Yard.

Chelsea.—For the Chelsea Electricity Supply Company, Limited, complete system in Sloane Square, Cadogan Square, Hans Place, Lennox Gardens, Pont Street, Sloane Street, and the adjoining streets from the stations in Draycott Place and Clabon Mews.

South Kensington. — For the Chelsea Electricity Supply for similar work in Egerton Gardens, Brompton Road, Ovington Square, &c., from the station in Egerton Mews.

Bath.—Underground mains for arc lighting for the public lamps throughout the city and for house lighting by transformers.

The firm has also supplied the cables for central station work at Lynmouth and Lynton; Gothenburg (Sweden), two companies; La Plata, Ensenada, Rossario, Buenos Ayres, for the River Plate Electricity Supply Company, Limited.

Among the very large number of orders for cables for use by the various firms of electrical engineers quite a feature has been the quantity of colliery installations for which Messrs. Callender's Company has manufactured mains.

A large number of private houses have also been fitted in all parts of England and Scotland, and the firm has been very busy supplying cables for the Navy, of the well-known yarn, bitumen, and lead-sheathed, type. Messrs. Callender have held the contract with the Admiralty for the past two years, and have supplied, through contractors, the wires and cables for many ironclads building on the Tyne and Clyde.

The past year has been a very busy one, and there is every indication, from the large number of orders already placed, that 1890 will be still busier.

MESSRS. IMMISCH & CO.

MESSRS. IMMISCH & CO. report a steadily increasing demand for electrical plant for lighting and transmission of power, both at home and abroad. During the year this firm has more than doubled the output of the preceding twelve months.

Amongst the plants turned out by this firm are a 70-H.P. hauling plant, for St. John's Colliery, Normanton; a 30-H.P. pumping and hauling plant for Llanerch Pit, Pontypool; a 30-H.P. pumping plant for the Shale Mines at West Calder; a 35-H.P. pumping and winding plant for tin mines in Bohemia; a 40-H.P. fan-driving plant for Bohemia, &c.

In connection with the Electric Traction Company Messrs. Immisch & Co., as chronicled in these columns, have been running self-contained tramcars on the North Metropolitan lines between Barking and Canning Town continuously for more than seven months. At the end of November, when five cars were running, the horses were withdrawn and the service depended entirely upon the electric cars. Each car makes, on an average, 60 miles per day, so that the possible car mileage per week is about 2,100. The total mileage yet made is about 40,000 miles. The cars have kept the schedule time within about 2 per cent.

The engineers report that the Electrical Power Storage Company's plates are standing the rough usage much better than was expected. Indeed, the chief difficulty experienced has been due to faulty burning of the lugs to the cross bars. Since the cells have now been in practically constant use for about seven months, the figures obtained are of some commercial value in estimating the probable cost of electric traction by accumulator cars. After carefully considering these the Electric Traction Company feel satisfied that their original estimate of 4½d. per car mile is well within the mark.

Messrs. Immisch's fleet of electric launches on the upper reaches of the Thames have met with great success, and in July and August the demand was so great that the resources of the company were taxed to their utmost. Next season it is intended to increase the number of launches and stations. The stations are five in number, four "floating," and one stationary at the head-quarters, Platt's Eyott, Hampton. There will be some ten or twelve launches ready for letting out in the season.

The firm has made some considerable progress in general lighting and installation work.

THE GENERAL ELECTRIC COMPANY, LIMITED.

THE General Electric Company, Limited, has during the past year increased both its manufacturing premises as well as its warehouses and offices. The factory in Manchester has been equipped, at great expense, with a quantity of new machinery, and now gives employment to over 300 men. The machinery, which is throughout of the latest type, comprises automatic screw-making plant, many new apparatus for brass finishing, clockmakers', cabinetmakers', and woodturners' tools, and a large plant for nickel and electroplating. Many new articles have been added to the list of manufactures, such as ammeters and voltmeters, arc lamps and telegraph materials, whilst the output in switches, cut-outs, ceiling roses, and general fittings, has largely increased. The firm has had the advantage of Mr. Reckenzaun's advice and general assistance, and with him have brought out a number of apparatus, with the production of which their experimental department is now fully occupied.

Clarke's patent electric gas lighter continues to be manufactured with unabated energy, and it is astonishing what a sale there is for it. Altogether, as a centre for the sale of articles, the Manchester works have proved a great success.

In London, the building in Queen Victoria Street is well known through its prominent position, and the business has been greatly facilitated by the commodious premises, although the company complains that its expectations as to this winter's business have not been realised, and attributes this disappointment to the fact that its customers, who comprise almost every contractor for electric lighting, cannot fulfil the calls made upon them, owing to the backward state of affairs in central stations in London and the provinces. Besides the increased sale of standard articles, the demand for specialities, such as Dr. Aron's electricity meters, Apostle carbons, and well-assorted designs in glassware, has been very great. Orders from all parts of the globe, especially from Australia and South America, keep coming in, and business, in general, looks very promising.

THE ELECTRIC LIGHTING OF ST. PANCRAS.

A well-attended meeting of the St. Pancras Vestry took place at the Vestry Hall on Wednesday last week, to consider the report and recommendations of the Parliamentary and General Purposes Committee and the Lighting Committee, acting by direction of the vestry as a Joint Committee on Electric Supply. The proceedings were extremely animated.

Mr. Churchwarden Boden having been voted into the chair, the Clerk read a letter from Mr. Alderman Eccleston Gibb, expressing the writer's regret at being too unwell to attend.

The Chairman asked the members of the meeting to confine their remarks, in the first instance, to the first of the Joint Committee's recommendations.

Mr. Councillor Westacott then moved that recommendation (*a*) of the Committee be adopted as follows: That it is expedient, in the interests of the parish, that the vestry should take steps forthwith to put in force the provisions of the St. Pancras Electric Lighting Order. After reminding the meeting that the vestry had obtained its powers under the Electric Lighting Acts some six years ago, and, quoting Major Marindin's report on the subject of electric lighting, he said, in the desire to gain a little more time before coming to a decision, the vestry had referred the matter to a Joint Committee, composed of their Parliamentary and Lighting Committees. Those two committees held meetings from time to time; they had had before them various reports upon the subject by Prof. Robinson, as well as information from other sources, and the vestry was now asked to agree to the result of their deliberations. The conclusions embodied in the report had been arrived at unanimously by the committee when twenty-five members were present. The committee felt that the time was come when the vestry should undertake to carry out the order it obtained in 1883. They were of opinion that it was better that the vestry should do it than that a company should do it. The inhabitants of St. Pancras ought not to be kept longer in suspense. It had been regretted over and over again that the supply of gas and water were monopolies; were they prepared to say that, in addition to gas and water, they would stand aside and allow another monopoly to creep in, when it was in their power to prevent it? It was said that the vestry would be incurring a risk—would be entering into a speculation. He was prepared to show that the risk was very small. First of all, they might be asked what would be the price of electricity as compared to gas; could electricity be supplied to the consumer as cheaply as gas? At the present moment, he admitted that it could not. The price would be about half as much again; but then the light would be fourteen times greater. Mr. Shoolbred had told him that if he could have his gas for nothing, and had to pay for his electricity, he would rather have electricity, and he was certain that at the end of the year he would be in pocket by it; because no injury to his goods resulted from it, no cleaning of ceilings, no risk of fire; and there were many other advantages which he derived from it which he had not, and never had had, while he was burning gas. Last week he (the speaker) visited Kensington and Knightsbridge. There was a company called the Kensington and Knightsbridge Company, whose premises were in the High Street. He went over their premises and he saw the company's engineer, and from him he learned that they were now supplying 14,000 lights to different people in Kensington, and he had himself seen that nearly all the large houses were supplied with electricity, and he had learned further, that in the last two years every large house and building in that particular neighbourhood, wherever the choice has been given between electricity or gas, had been fitted up with electricity, because the advantages of having it were recognised. He had inquired the cost of electricity as compared with gas, and strange to say, the figures given him had been almost identical with those named in the committee's report, viz., sixty per cent higher, but then the light was so much better and at the end of the year the consumers found that they had not paid more for it than they had formerly paid for gas. The reason of that was very simple; when they used gas, they were accustomed in going from one room to another to turn the gas down, but for all that the gas was still burning, whereas if they used electricity they had only to turn off the switch and there would be no waste. He could understand why it was that electric companies never declared a dividend. He had been told by the manager of the Kensington and Knightsbridge Company that the company could, if it chose, declare a 10 per cent. dividend; that was to say, so long as the companies could not get the entire monopoly of electric lighting into their hands, they did not wish the Government and the public to know what dividends they could pay. If they could secure a monopoly in the same way as gas and water companies had done it would very soon be seen that dividends could and would be declared. He might be told that the vestry could supply electricity at 4¼d. per Board of Trade unit as against the 8d. which the companies could charge; but he for one was not prepared to set the price down too low to begin with. He thought the better way would be to begin at 6d. or 7d. and reduce the price gradually. The Joint Committee felt very strongly, that as the only vestry in London that enjoyed the power and the ability to undertake the supply of electricity, they ought not to let the opportunity escape them. If they were unprepared to take the matter up, it meant they would lose the power of doing so for forty-two years, that being the time allowed to the electric companies before their powers could be acquired by the public bodies. The issue before them was whether the vestry should undertake the work or hand it over to the companies for the next forty-two years to charge 8d. per unit, as against the 6d. or 7d. which they, the vestry, would charge? As regards Professor Robinson, that gentlemen had had thirty years experience of important public works in connection with public bodies which, including the construction of reservoirs and pumping stations, the laying of mains, and the designing of works for the supply of compressed air. He had been proposed as a member of the Institute of Electrical Engineers by the President of the Institute, seconded by Mr. Preece, the Government electrician, and supported by many leading electricians; and, on the 9th of the present month, he would be an electrical as well as a civil engineer.

Mr. Wilson seconded the motion. It had been said that the vestry had no right to become traders; but they were already traders in baths and wash-houses, cemeteries, and other matters which it would have been unwise to leave to private companies.

Mr. Bolton moved: That a public meeting of ratepayers be called by the vestry to consider the question before any money is expended.

Mr. May seconded the amendment.

Mr. Wilson said that it had taken the committee nearly six years to understand the question, and it was not likely that a meeting of ratepayers would be any better qualified to decide it.

Mr. Upton could say that if the vestry had 10,000 lights to dispose of there was an enterprising class of men at Camden Town, viz., the licensed victuallers, who would readily take them up at 6d. per unit.

Mr. Barnes thought it would be utterly useless to call a meeting of the ratepayers. Why had they a vestry if not to represent the ratepayers? They were asked to provide electric lighting, the profits of which, if successful, were to be applied to reducing the rates. It was well worth the trial even if they failed.

Mr. Clements agreed that it would be a mistake to call a public meeting. He objected to the measure on its merits. It was a speculation of considerable magnitude which the vestry ought not to enter upon, as it would involve them in all the risks and uncertainties of trade speculations. Governments and public bodies ought only to engage in such undertakings when no one else would do so. The analogy of water was misleading. Water was a necessity which must be had at all costs; whereas electric lighting was a luxury which would not benefit the poor people, although it might be of considerable advantage to those who were comfortably off and did not mind a few pounds extra being added to their expenses. The large capitalists were, no doubt, benefactors to the community, still he did not think the vestry had a right to levy taxes in order to supply them with cheap lights. He did not share in the prejudice against the licensed victuallers; nor did he think they possessed such claims upon the vestry that it ought to levy rates for their benefit. They were told that the electric lighting was to cost them from 50 to 60 per cent. more, and give them 14 times more light. The truth was that the incandescent lamps, equal light for equal light, cost from 20 to 30 per cent. more than gas light. The cost of arc lights was three times that of gas; on the other hand, they gave 14 times more light. For public lighting that was an excessively bad speculation. The cost of replacing the existing gas lighting, which was good enough for all practical purpòses, for something three times as beautiful and brilliant at three or four times the cost was very bad finance indeed. Mr. Gibb's scheme was that the parish should spend the whole of the profits made by private lighting upon 90 arc lamps, and thus save the 400 ordinary gas lamps which were costing £1,120 or so per annum. That meant that for all their trouble they would get something like 2½ per cent. per annum as profit. They were in the region of estimates. His experience was that the best estimates were dangerous. He had a lively and painful recollection of their last building speculation. He referred to the coroner's court and mortuary. That was nothing like in magnitude to the present scheme. They had no right to speculate in luxuries. They had been told very airily that they were going to sell as many lights as they pleased, but they had no solid and serious assurance that they would get the number of customers they expected, nor could they have any. Kensington, which had been cited as an example, was one of the richest centres of London. St. Pancras contained a quarter of a million of inhabitants, and they were asked to risk the money of the entire parish for the sake of a portion of it—viz., the south. Who would venture to suppose that within any measurable time the northern portion would be in a position to take the electric light! In plain English, they were being asked to tax the poor for the benefit of the rich ratepayers. The proper course would be to make a good bargain with a company, taking care that it had the risk and not too much of the profit, by which means all the benefits the vestry hoped for could be had without any risk.

Mr. PURCHASE asked why, if they believed in electricity, they had not come forward with a complete scheme for the entire parish. The reason was that they had a doubt in their minds. The thing was a speculation. Shoolbred and Maple had the electric light, it was true; but they had always the gas alongside of it. So it was with the Metropolitan Railway and other wealthy companies, and if those bodies, which were formed for the purpose of paying large dividends to their shareholders, did not think it wise to incur the risk, was it wise for the vestry to do so merely to favour a few Tottenham Court Road traders?

Mr. BAKER said he was not a shareholder in gas or electric lighting companies, and therefore was entirely unbiassed, except that he was in favour of lighting by electricity. But he was not in favour of running a dark horse at the ratepayers' expense. They could not say at present whether electricity would or would not pay. The late Metropolitan Board of Works had tried it on the Embankment and for Waterloo Bridge, and the expense had been too great. Three or four years back the City of London was lighted entirely by electricity, but even with its enormous revenues it could not afford to continue the expense. The Town Surveyor of Eastbourne had told him that the expense of electric lighting was so great, that the rates would have to be raised £30 (laughter) if it was to be maintained. They need not study the rich people of Kensington; but he ventured to say that not half the large buildings in Kensington were lighted by electricity. The question was not one of dirty ceilings, but whether it would be a commercial success. He did not think it would.

Mr. WETENHALL said the inhabitants of the ward he represented, most of whom were very poor, were largely in favour of the scheme.

Mr. ROBINSON said the unfortunate ratepayer was always being trotted out. If they did not adopt the committee's recommendation, they would lose their control over the lighting for the next two generations. Were they going to allow monopolists to regulate their lighting for the next 42 years?

Mr. LAZARUS was entirely in favour of the vestry doing its own lighting, but not just yet. It was to considerably misstate the case to say that if they did not take up their power now they would lose it for the next 42 years. They could sublet the first installation, and purchase it back, if they thought fit. That was what the City of London was doing He doubted very much whether the vestry possessed the requisite practical knowledge at present.

Mr. WESTACOTT said it was true that the City had made contracts with companies, terminable in seven or fourteen years, but it had only been able to do so by giving the companies the option of supplying private persons.

Mr. SWEET said the difficulty at these meetings was to get members to speak the truth, and only the truth. There was no doubt about there being a demand for the electric light, whatever the price might be. The electric lighting companies were confident it would be a great success; so were the gas companies. The vestry could supply it much cheaper than the companies. They would not reduce the price of gas very much if they could only supply it at 8d.; it would be otherwise, however, if they supplied it at 5½d. They were getting very particular in sanitary matters, and gas might at any time be condemned as injurious to health. Arc lighting, if it could be applied for general purposes, would be very much cheaper than gas. Arc lamps were now made smaller, and he hoped they would in the future be used for purposes which their present size rendered them unsuited to. Most of the companies employed alternating currents of high tension, which were dangerous. If a current was to be profitably used for the purposes of machinery, it must be constant. He could imagine scores of purposes for which their current could be used, and which were not mentioned in the estimate: artificial ventilation, for instance. If they had their plant working all the day for the puposes of machinery, and all the night for the purpose of lighting, they would be doing a very profitable business.

Mr. BOLTON's amendment was then put and lost.

Mr. MORELL then moved: That the opinion of the inhabitants of the parish be taken by ballot before the vestry embarks upon the scheme submitted to it. How, he asked, did they know that the electricity of the present day was what it would be in three years time, or that the plant they put in would not have become obsolete in a year or two?

The amendment, which was seconded by Mr. Brown, was lost.

Dr. FORSYTH then moved: That the matter be referred back to the Joint Committee with a view of making arrangements with some one of the electric lighting companies by which the experiment of the first installation can be tried on terms which shall, on the one hand, prevent the erection of a monopoly, and, on the other, save the parish from the risk of adopting the committee's plan.

The Rev. Mr. BELL seconded the amendment. The methods of applying electricity of the present day would not be the same as those of a twelvemonth hence. If there was any possible way of putting this great burden upon any company, let them do so.

Mr. WESTACOTT reminded the meeting that six months ago the vestry had been in negotiation with three companies for the supply of electricity to the parish for 23 years, on which occasion they had been told that unless they were prepared to buy the lighting at the end of that period, as a going concern, it would not pay any company to undertake the business. In March last the vestry had rejected the very proposal which was now before them.

Mr. CLEMENTS said that no serious offer had ever been made to any company. The reason why those negotiations failed was that they tried to fix upon the companies an undertaking to light the entire parish.

The amendment was then put, and lost; and, on Mr. Clements demanding a division, the meeting divided, 18 for it and 42 against.

Mr. LAZARUS then moved: (*a*) That in the present comparatively early stage of electric lighting it is inadvisable for the St. Pancras Vestry to undertake the installation. (*b*) That the vestry, having obtained the necessary powers to undertake the management and installation of its own electric lighting, do sub-let to a public company by public tender, the first installation of, say, 1,000 incandescent lights of 16 candle-power each, and 90 arc lights. (*c*) That a clause be inserted in the conditions of tender empowering the vestry, after 7, 14 or 21 years, at its option, to purchase and take over the installation, in all its parts, from the company, at a price not to exceed twice the cost of the installation.

The amendment was put and lost.

The meeting then adopted recommendation (*a*), as also the remaining recommendations of the Joint Committee as follows:—

"That in the first place it is desirable to secure a site and carry out one installation for the supply of electricity for public and private lighting, and for motive power, such site to be of sufficient area to allow of extension.

"That the site obtained should be so situated as to form one of several sites, and so part of a complete scheme for the whole parish, which scheme will require, say one installation in each of the four Parliamentary Divisions.

"That it is desirable to carry out the first installation, in view of the complete scheme with several stations hereafter, inasmuch as such scheme will be attended with the advantage of enabling each station to supplement the others in case of temporary need.

"That your committee be authorised to obtain plans, specifications, estimates, and tenders for carrying out a first installation for the supply of electricity for purposes of light and motive power of an extent sufficient say, for 10,000 incandescent lights, of 16 candle-power each, and 90 arc lights.

"That the premises in Edward Street, belonging to the vestry, be (if possible) appropriated for the purposes of this installation.

"That authority be given to the committee to further employ Professor Robinson for the purpose of preparing the necessary plans, specifications, and estimates, assisting in obtaining tenders, and superintending the carrying out of the first installation; that he be paid for his services at the rate of four per cent. on the amount of the tenders, provided the tenders do not exceed his estimate, and in the event of their doing so, then on the amount of his estimate, such commission to include all personal services and assistance, and that in the event of the vestry deciding not to proceed upon the tenders, he be paid one-half of such commission in full settlement of all claim for services from the 30th June last, the date of the last settlement, such engagement to be subject to a proper agreement being entered into between the vestry and Professor Robinson.

"That authority be given them to call in, if they deem it necessary, Dr. Hopkinson, or some other electrician of great eminence, as a consultant, so as to have a second professional opinion upon any plans, specifications, estimates, or tenders, or upon the carrying out of the works."

The meeting then broke up.

ABSTRACTS
OF PUBLISHED SPECIFICATIONS, 1889

10744. "An improved process for the manufacture of filaments for electric incandescence or glow lamps." E. DE PASS. (Communicated from abroad by A. de Lodyguine, of Paris.) Dated

July 3. 8d. Claim:—The process of manufacturing carbon filaments or incandescents for electric glow lamps from organic material, consisting in dehydrating and decomposing the filaments or incandescents by the action of a chemical agent, then subjecting them to a high temperature with the exclusion of oxygen, expelling the occluded gases from the filaments or incandescents by subjecting them to a high temperature by the passage of an electric current, and, finally, giving them the required resistance by the deposition of carbon, substantially as described.

11341. "Improvements in recording apparatus for electric meters." G. W. WALKER and W. BRACKEN. Dated July 15. 8d. The primary feature or basis of the invention rests in the procuration of a photographic impression or copy of the fluctuations or variations of the movable or indicating part of the measuring instrument. 14 claims.

11471. "Improvements in electric accumulators or storage batteries." E. N. REYNIER. Dated July 17. 8d. Claims:—1. Constructing accumulators in which the electrodes, suitably insulated from each other, are contained in flexible receptacles, to the outer end surfaces of which are applied rigid pressure plates parallel to the electrodes, and connected together by springs of metal, caoutchouc or other material, so as to exert an elastic pressure upon the electrodes, substantially as and for the purposes described. 2. Combining two or more accumulators with flexible receptacles, such as are referred to in the preceding claim, into a single battery, to the ends of which are applied rigid pressure plates acted upon by springs, with or without supporting flanges and auxiliary intermediate pressure plates, substantially as described. 3. In batteries constructed as set forth in the preceding claims, the use in combination with the pressure and supporting plates of one or more supporting bars, or of a combination of such bars forming a cage or framing for supporting the battery, and either provided or not with a base upon which the battery rests, by preference with the interposition of elastic bands, substantially as and for the purposes described.

11780. * "Improvements in dynamo-electric generators." C. E. BUELL. Dated July 24. 8d. Relates to the class of dynamo-electric machines that accumulate a charge to be sent through a circuit for firing fuses in blasting, and for other purposes where a quantity discharge of brief duration is desired. Consists of a generator comprising a spring actuated armature and a condensing circuit formed by the movable parts of the apparatus that are in such relation to each other as to be electrically connected during the process of accumulation, and to become electrically separated at the desired moment in the process of accumulation, substantially as hereinafter described. Further consists in the combination with a dynamo-electric generator of a condensing circuit that is completed during the process of accumulation through the actuating mechanism, and a spring actuated armature that is automatically released at a predetermined point in the winding of the spring, substantially as described. 7 claims.

12046. "Improved composition adapted to electric insulators and other articles and uses in the arts and manufactures." F. MARQUARD. Dated July 30. 6d. The improved composition consists of rosewood, sawdust, wood-pulp, extract of logwood, bichromate of potash, sulphate of iron, animal glue, an albuminous substance such as bullocks' blood, and vegetable fibre. 4 claims.

12082. "Improvements in the arrangement and regulation of electric motors for traction, marine propulsion, and like purposes." A. J. JARMAN. Dated 30. 8d. Chiefly relates to the proper regulation of electric motors when these are subjected to an intermittent load, which may vary considerably while said motors are in action; and has for its object the arrangement of two electric motors, called a double or compound motor, in such a manner that the "torque" thereof may be increased in inverse ratio to the speed rate, or the rate of speed may similarly be increased in inverse ratio to the "torque," or the operative parts of said compound motor may be so divided as to allow one part thereof to be electrically inactive while the other part is performing mechanical work, and absorbing electrical energy; all these several degrees of regulation being carried out by means of a single switch, commutator, or other device. 5 claims.

12145. "Improvements in generating electricity or magnetism by the application of heat." P. M. JUSTICE. (A communication from abroad by E. G. Acheson, of America.) Dated July 31. 8d. Claims:—1. The combination of an electric conductor conveying a current of changing value, a mass of material magnetised thereby, and a source of heat arranged to influence said mass, substantially as described. 2. The combination of an electric conductor conveying a current of changing value, a mass of magnetic material magnetised by said current, a source of heat arranged to influence said mass, and a second electric conductor, including a translating device, and arranged within the influence of the magnetic mass, substantially as described. 3. The combination with an electric conductor through which varying electric currents are passed, of a thermo couple arranged in inductive relation to said conductor and a source of heat, substantially as described. 4. The combination with an electric conductor of a magnetic core energised thereby, thermo couples arranged in inductive relation to said core, a source of heat for said couples, and a circuit including the couples and a translating device, substantially as described. 5. The method of converting heat energy into electric energy, which consists in causing heat energy to traverse the elements of a thermo couple, and subjecting said currents to the influence of changing lines of magnetic force, substantially as described.

12760. "Improvements in electric motors for street cars." W. S. SALISBURY. Dated August 13. 11d. Relates to improvements in electric motors for street cars, and the attachment of the boxes containing the batteries to the body of the car, in which the power of the secondary batteries carried upon the car is transmitted by means of suitable gear connections between the motors and the car axles. The prime object of the invention is to have the battery boxes detachably suspended from the body of the car in such manner that they may be readily removed from the side of the car for recharging, and the substitution of other batteries, and to have the boxes containing the batteries suspended in such manner that they will remain unaffected by the vibrations or teetering of the car occasioned either by unevenness in the track or in the ascending or descending of a hill, so that the battery boxes will remain at all times in a substantially horizontal position, whereby the spilling of the battery fluid is avoided. 14 claims.

13480. "Improved switching apparatus for charging storage batteries." W. P. KOOKOGEY. Dated August 27. 8d. Consists as a whole, and as applied to the charging of a storage battery, of the combination of a generator and storage battery, the latter being divided into sections; two series of stationary contacts connected with such sections; and two conductors or contact points connected with the respective poles of the generator, of which they form the respective terminals, adapted to move in unison, and thus by means of the stationary contacts arranged adjacent to them, make contact successively with the successive sections of the storage battery; also of the combination of a storage battery, generator, stationary contacts leading to sections of the storage battery, and synchronously moving conductors, with an electro-depositing cell, forming part of the main charging circuit, and having one of its plates movable and attached to one of the arms of a balance beam; by the alternate movements of which balance, under the increased or decreased weight of the movable plate, in the depositing cell, the synchronously moving conductors are caused or allowed to move in unison at regular intervals from one stationary contact to the succeeding one, the current through the depositing cell being reversed at each change of the balance. 5 claims.

CORRESPONDENCE.

Heating of Conductors.

Now that you have published the two tables I sent you for comparison, it seems to me desirable that something should be said as to their utility.

A rule limiting the current to conductors by a rise of temperature above air, if unaccompanied by a table, would be useless to the majority of those having to apply it. The surveyor has no time for complex and abstruse calculations. He must be provided with the means of ascertaining without trouble and at a glance, whether the current carried by a conductor is within the limit prescribed by the rule. No doubt some such consideration as this led the American committee, in the first rules ever issued on the subject, to adopt a hand test for temperature limit—a rough and very unscientific method.

The 10° Cent. limit above air allows for double the working current and an initial temperature of nearly 100° F., and is yet well within the limit recommended by the Institution of Electrical Engineers. So that so far as mere safety is concerned, Mr. Kennelly's figures may be regarded as perfectly reliable. But the electrical engineer has other things besides safety to consider. He has to consider the satisfactory working of the system as a whole, and cannot neglect the question of loss of volts in his conductors. Hence the figures given must not be regarded as a working table suitable for any installation, but rather as a guide to the limit imposed.

It is but due to Mr. Preece to say that his contention as to some of the data used by Professor Forbes being unreliable, is supported by the experiments of Mr. Kennelly. At the same time, it would appear that, when due corrections have been made the result does not show the 30 to 40 per cent. difference Mr. Preece looked for. Mr. Preece, however, has yet to be heard on the subject.

Let us now take the revised formulæ and apply it to those wires and cables mostly met with in actual practice. The annexed table gives the result, and a column is appended of current densities for comparison. This latter is instructive and proves that the usual basis of wiring adopted in this country—viz. 1,000 ampères per square inch section, when not carried much above 100 ampères, gives a very wide margin of safety and at the same time is in other respects satisfactory.

Table according to the formula of A. E. Kennelly, for insulated conductors of S.W.G., calculated for 10° *Cent. rise of temperatare, due to current, above air.*

S.W.G.	Diameter in Inches.	Amperes.	Amperes per Square Inch.
20	·036	3·9	3800
18	·048	5·9	3250
16	·064	9·0	2800
14	·080	12·6	2500
7/22	·084	13·6	2450
7/20	·108	19·8	2150
7/18	·144	30·5	1870
7/16	·192	47·0	1680
7/14	·240	65·8	1450
7/12	·312	97·8	1275
19/16	·320	101·	1250
19/14	·400	142·	1130
37/16	·448	168·	1060
37/14	·560	235·	950
37/12	·728	347·	830
37/10	·896	475·	750

H. Human.

Guardian Fire Office, E.C.

Electrical Engineers.

I have read your leading article on "Electrical Engineers" with great pleasure; but there is one passage which, I think, would have been better omitted, and which is, in my opinion, calculated to injure a number of young electrical engineers. I refer to your allusion to what everyone must know to be the Hanover Square School. There may be a certain amount of truth in it, but it is, nevertheless, quite uncalled for; indeed, the opinion of the editors must have changed since the 20th January, 1888, for on that day the then editor was kind enough, in reply to my question, to recommend me to go to the Hanover Square School, and was also kind enough to tell me the "appropriate weight" of the fee necessary to make the machine work. As for the past students asking £200 a-year to commence with, I doubt it. I only know that I offered my services free for six months to nearly every firm in London, and, after all, I succeeded in obtaining a position where I gave time, but in four months have had two "rises" without asking for them, so I was evidently not "too good for the place." While on this subject, I will say that even now I would give up the magnificent salary I receive, and give six months to any *good* central station or dynamo manufacturing firm, if I got the chance; but I know full well that pupils at £100 per annum pay so well, and are so little trouble (the fees being payable in advance), that I shall not be called upon to sacrifice my hard-earned stipend.

Trusting you will forgive the length of this epistle,

Philip Peters, *A.I.E.E.*

January 6th, 1890.

Killing Birds by Electric Shocks.

I enclose a copy of *The Animal World*, in which you will notice a system described for slaughtering swallows with the electric current. As I take a great interest in electrical matters, this has been mentioned to me by several of my friends, and I have always told them that it was all nonsense. That birds are killed by flying against wires is quite certain, as we all know, but that wires could be erected for the purpose of killing them by means of the current, must be quite untrue, as the birds would require to have a foot on each wire or have some other means of causing the current to short circuit through their bodies. I will be very much obliged if you will take notice of this in your very valuable paper, letting me know whether there can be any truth in the report or not.

W. Scott Elliott.

Hawick, *January 7th*, 1890.

[We have seen reports of the nature given in the *Animal World* for some time past, and we imagine that some device has been set up for the express purpose of killing swallows, although, of course, the illustration which is given in the paper above mentioned, does not represent an effective method of slaughtering these innocent creatures, except in the manner suggested by our correspondent. Perhaps some of our readers may be able to afford some information of a reliable nature? EDS. ELEC. REV.]

Electropathic Appliances.

Having perused with great interest your recent articles with reference to the exposure of the so-called "Medical Magneto-Electric Batteries," I beg to enclose you one of their order forms, which, it seems, they are sending all over the country.

I quite agree with you that measures ought to be adopted to make it impossible for such rubbish to be sold. One of my friends bought one of each of these sham medical *belts* and *batteries* and found the same perfectly worthless.

I annex my name as good faith, and not for publication,

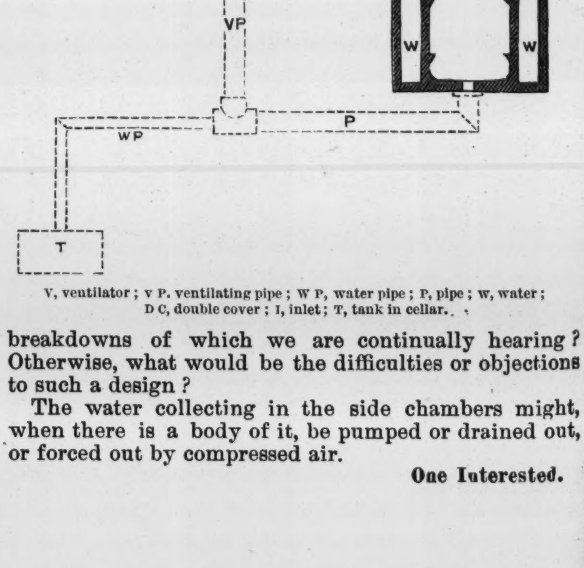
Fair Play.

Halifax, *January 7th*, 1890.

[We have seen many order forms like the one sent. Naturally the twaddle extolling the use of electro-magnetic socks is too transparent to need any comment; as to the battery, a reference to a back number of the REVIEW will show the apparatus dissected and shorn of its marvellous properties.—EDS. ELEC. REV.]

A Suggestion.

Having recently been thinking over electric lighting, permit me to enquire, through the medium of the REVIEW, whether a conduit constructed as per the enclosed sketch would not obviate the explosions and breakdowns of which we are continually hearing? Otherwise, what would be the difficulties or objections to such a design?



V, ventilator; V P, ventilating pipe; W P, water pipe; P, pipe; W, water; D C, double cover; I, inlet; T, tank in cellar.

The water collecting in the side chambers might, when there is a body of it, be pumped or drained out, or forced out by compressed air.

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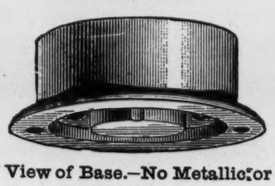

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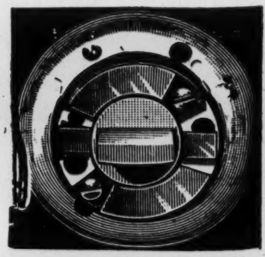

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Yellow Deal - -	5/4	6/9	8/-	9/6	11/10	14/7	18/8	Per 100 ft. run.
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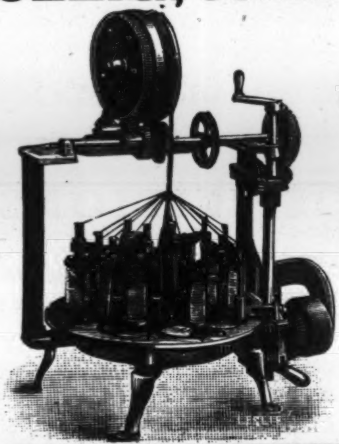

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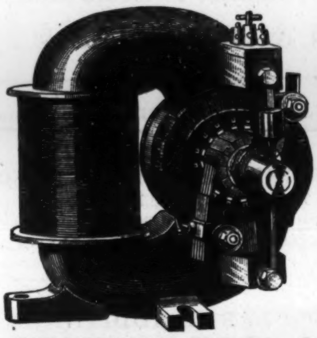

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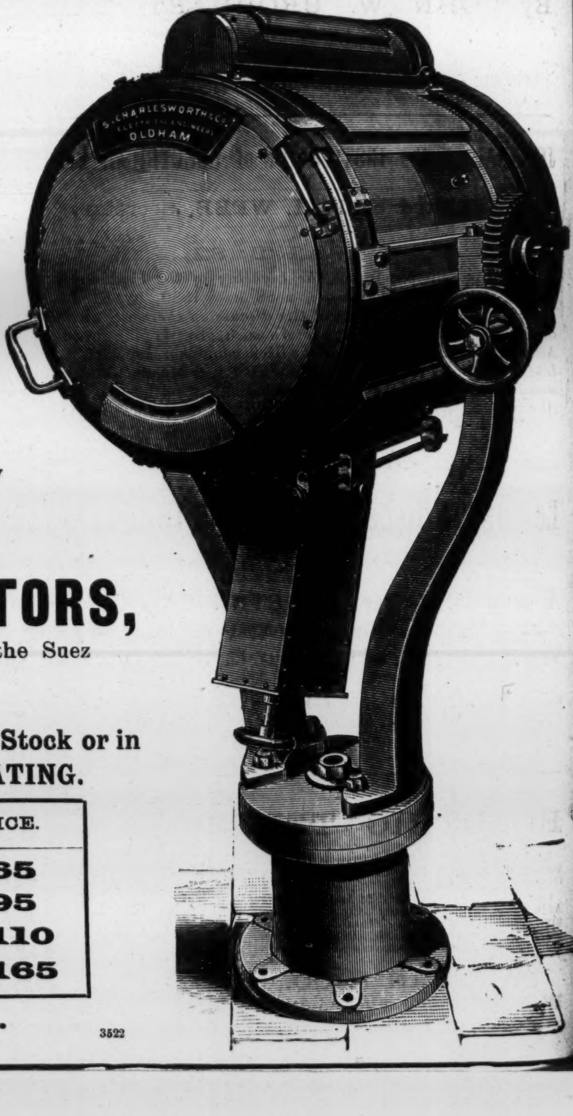

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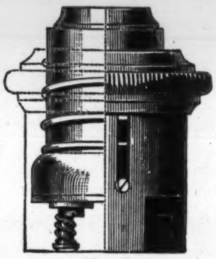

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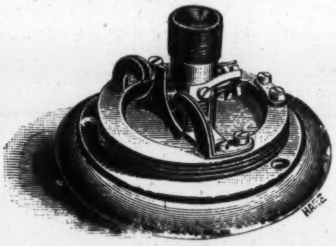

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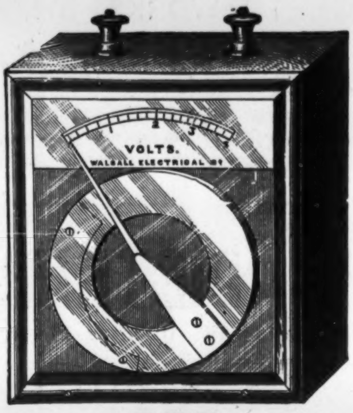

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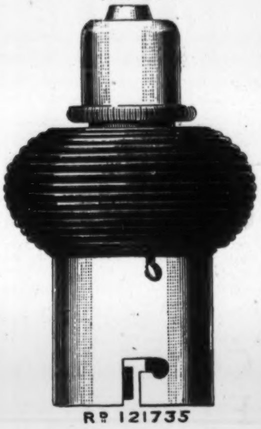

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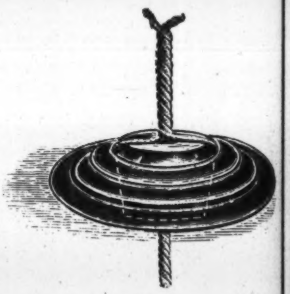

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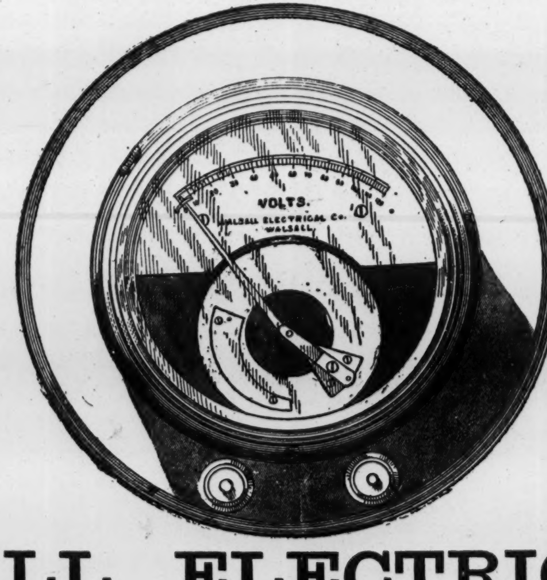

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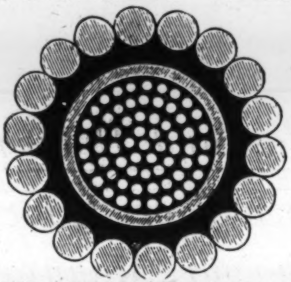

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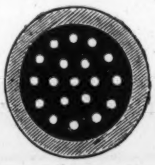

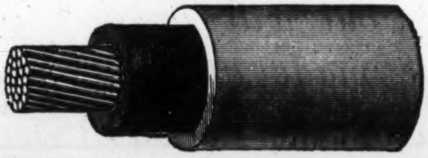

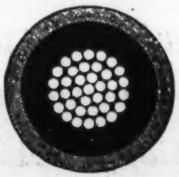

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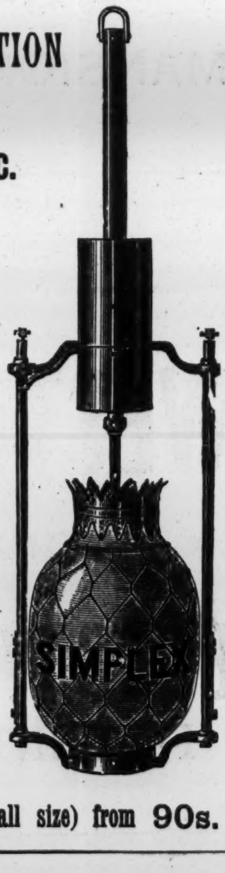

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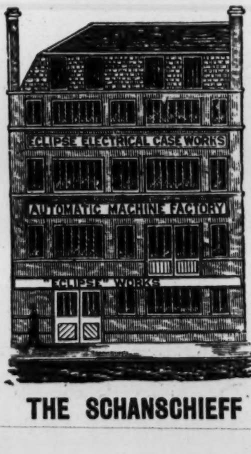

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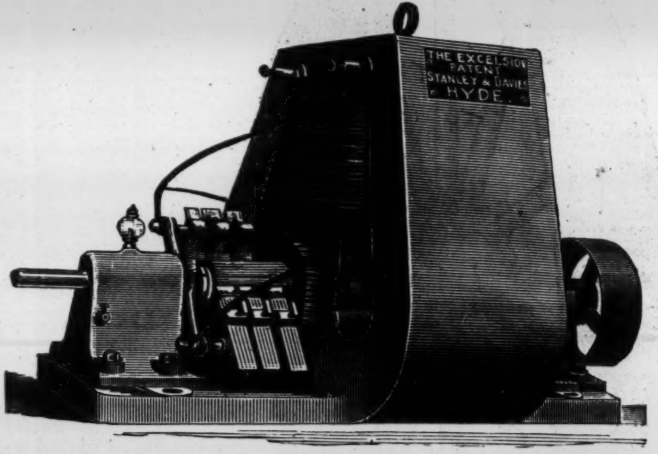
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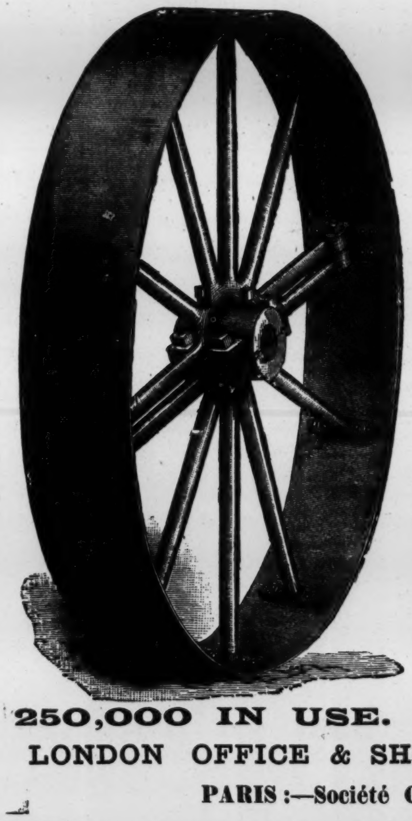

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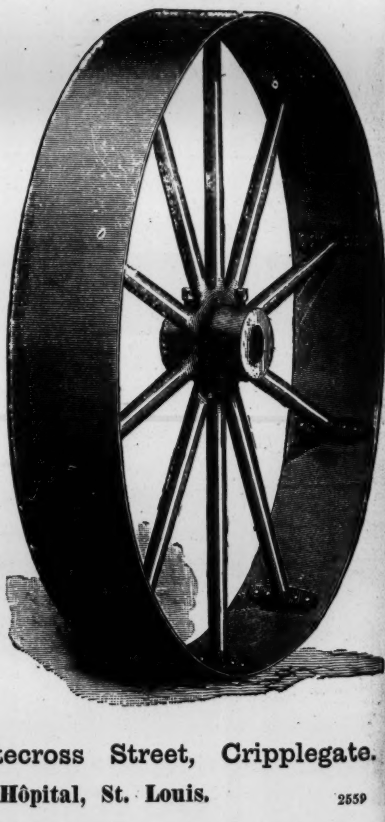

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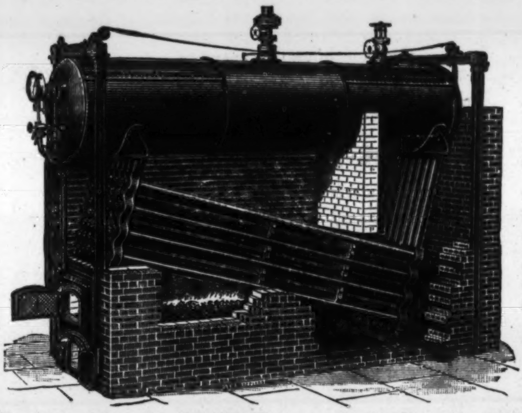

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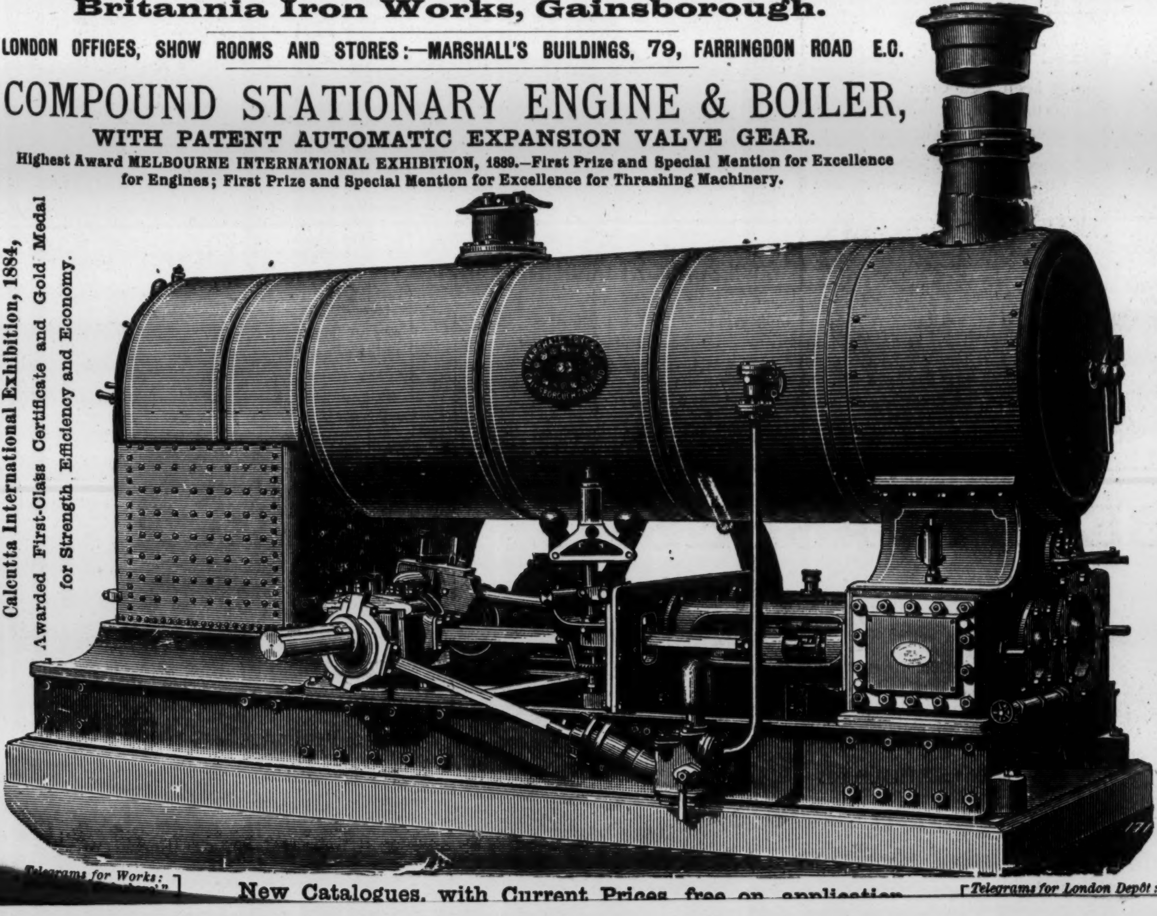

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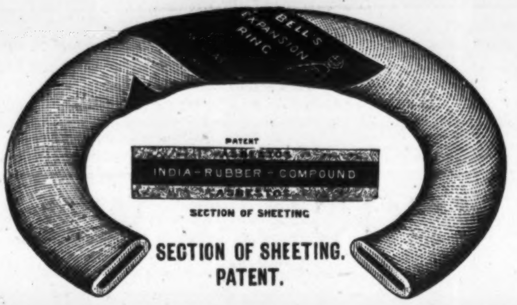

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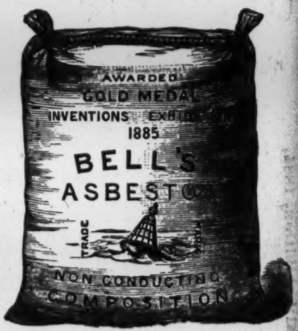

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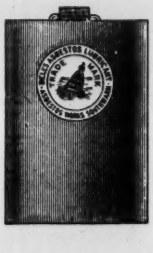

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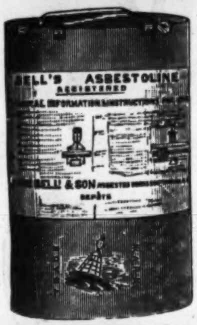

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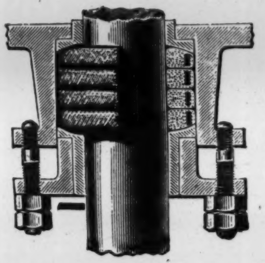

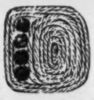

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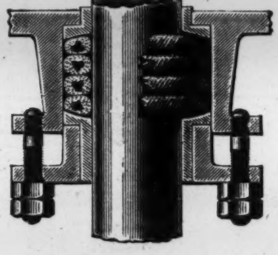

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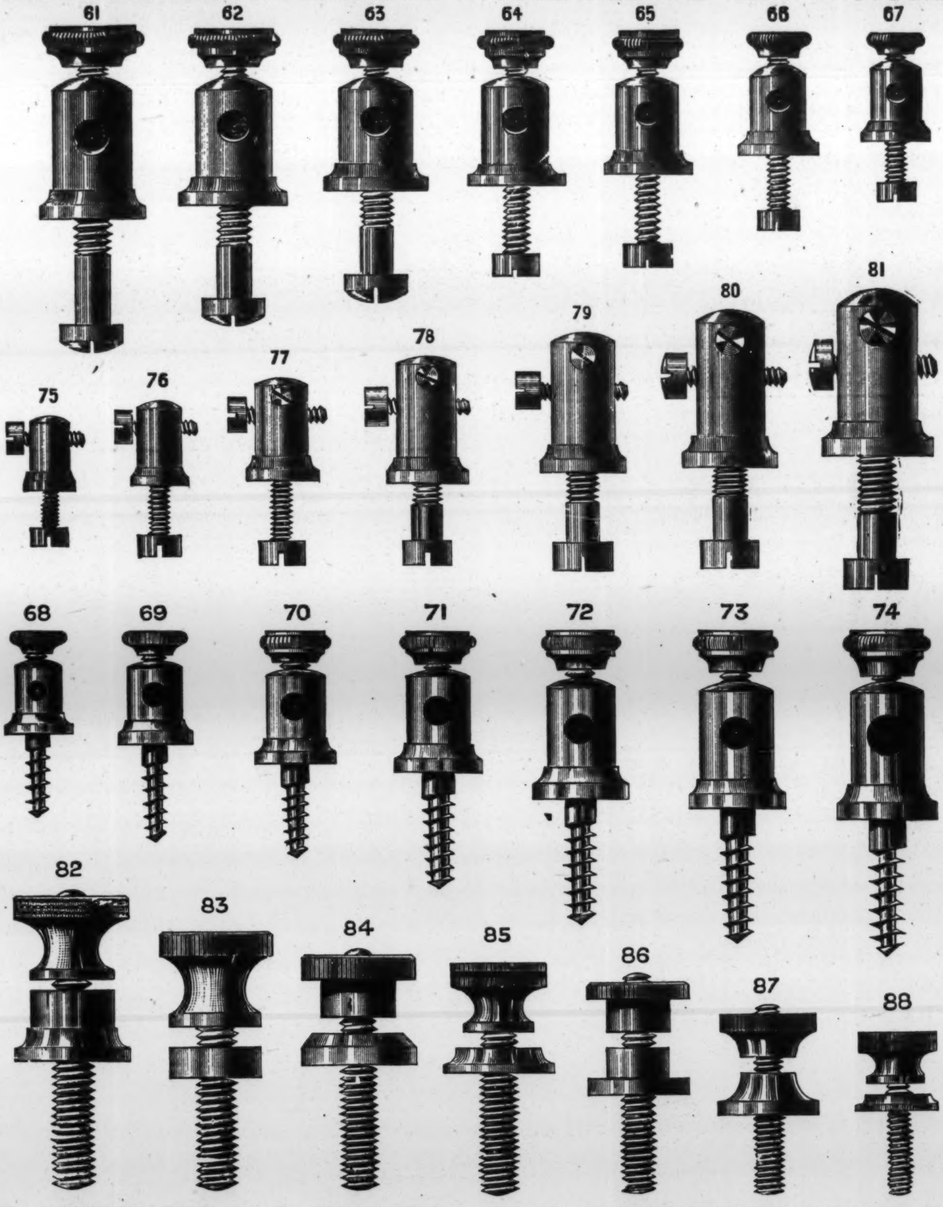

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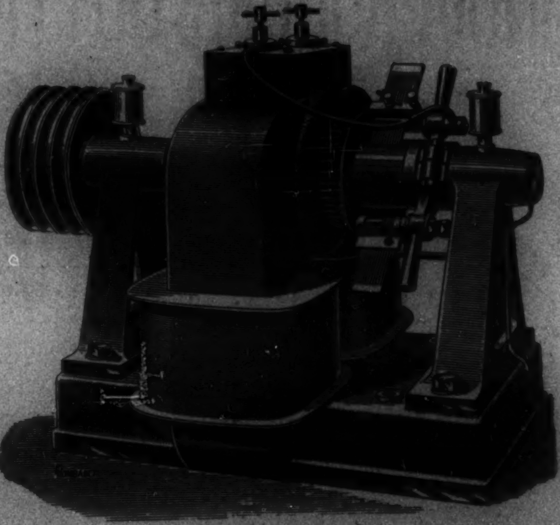

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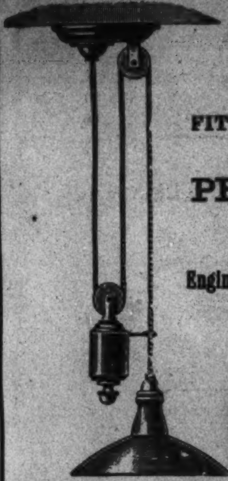

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